S/N. A3850

Texscan CORPORATION

OPERATING AND INSTRUCTION MANUAL

MODEL VS-20

SWEEP GENERATOR

S/N A3850

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SECTION 1

SPECIFICATIONS

1.1	FREQUENCY RANGE	500 Hz to 25 MHz. The unit can be centered at any frequency between 500 Hz and 25 MHz and sweep anywhere within that range.
1.2	FREQUENCY DIAL ACCURACY	Within 2% of the maximum frequency.
1.3	SWEEP WIDTH	Sweep width is continuously variable from 500 Hz to 25 MHz at any center frequency, but the unit will not sweep above 25 MHz at rated output. The unit is provided with a CW output mode for signal generator applications.
1.4	RF OUTPUT	RF output is at least 1.0V rms into a 50 ohm load.
1.5	FLATNESS	Flatness is $\pm$0.25 dB at maximum sweep width (tested with a Texscan CD-50 detector).
1.6	HARMONIC DISTORTION & SPURIOUS	All frequency components due to harmonic distortion, and all spurious frequencies are typically 30 dB down from maximum rated output.
1.7	LINEARITY	The linearity is within 2% of maximum sweep width as referenced to a straight line function.
1.8	STABILITY	Drift is less than 5 kHz per hour after a 15 minute warmup at 1 MHz.
1.9	RESIDUAL FM	The residual FM is better than 200 Hz.
1.10	MARKERS	The unit has a birdie-bypass marker system with provision for up to eight single frequency or har-

	monic markers. An external marker input is provided which can be used with a CW source to produce a variable marker. A 100 mV signal produces a marker greater than 1.0 volt peak-to-peak.
1.11 SWEEP RATE	Five sweep rate modes are provided: (1) variable from 5 Hz to 60 Hz, (2) variable from 0.05 Hz to 5 Hz, (3) 50/60 Hz line rate, (4) manual sweep, and (5) external. The external sweep drive has an input impedance of approximately 100K ohms. A 24 volt peak-to-peak waveform will produce maximum dispersion. The unit will respond to input drive frequencies as high as 30 kHz.
1.12 ATTENUATION	The unit has a 0 to 6 dB vernier control of RF output and a rocker switch attenuator which provides 0 to 102 dB in 1.0 dB steps.
1.13 ALC MONITOR	Both an internal leveling system and facility to use an external monitor are provided. If an external monitor is used, it must provide a DC signal of at least -0.5 volt for proper leveling.
1.14 RF OUTPUT CONNECTORS	BNC (standard). TNC, Type N, or Type F on special order.
1.15 HORIZONTAL DRIVE	A triangular waveform of at least 10 volt peak-to-peak is provided for oscilloscope horizontal drive. The horizontal output impedance is less than 10K ohms.
1.16 SIZE	6 7/8" X 17" X 16".
1.17 CONSTRUCTION	Aluminum with G-10 printed circuit boards.
1.18 WEIGHT	Approximately 23 lbs. Shipping weight is 27 lbs.

1.19 POWER

Approximately 15 watts, 50/60 Hz, 115/230 volt power.

1.20 OPTIONS

1.20.1 75 Ohm Output Impedance

The VS-20 can be supplied with a 75 ohm output impedance (option Z).

1.20.2 Variable Marker

A calibrated variable marker can be supplied with the following characteristics:
Frequency Range: 500 Hz to 25 MHz.
Accuracy: (principally determined by dial readability); 150 kHz.
Marker Amplitude: 1.0V peak-to-peak minimum.
Marker Width: Approximately 50 kHz to 200 kHz (option M).

1.20.3 RF Markers

The VS-20 can be built so that the birdie markers modulate the RF output for tape recorder applications. This option is useful whenever the test application includes equipment with long time delays which result in marker placement errors in the birdie-bypass system being used. (Option T).

1.20.4 1.0 kHz Modulation

The unit can be provided with a switchable 1.0 kHz amplitude modulation function. (Option I).

1.20.5 External Modulation

The unit can be supplied with uncalibrated external amplitude modulation capability. Low distortion AM can be achieved at rates as high as 10 kHz with 90% modulation. (Option S).

1.20.6 Pen Lift Feature

A rear panel connector can be supplied which provides a short circuit during sweep time and an open circuit during retrace to use with the pen lift feature on a graphic recorder. (Option P).

1.20.7 Rack Mount Kit

The Texscan cabinet can be easily converted for rack mounting with an optional kit. (Option RM).

1.21 RECOMMENDED ACCESSORIES

1.21.1 Log Detector	Texscan Model LN-40A.
1.21.2 RF Detector	Texscan Model CD-50.
* 1.21.3 Harmonic Markers	Texscan HM-0.1, HM-1.0, and HM-5.0.
1.21.4 External Monitor	Texscan Model EM-50.
1.21.5 Cable Set	Texscan Model 501.

* Special frequencies are available from Texscan type SM plug-in markers.

SECTION 2

GENERAL DESCRIPTION

2.1 GENERAL INFORMATION

The VS-20 sweep generator is a solid state instrument that provides wide frequency coverage, variable sweep rate, external marker capability, and complete control of the RF output level. This unit has provisions for accepting up to eight single frequency or harmonic plug-in markers for frequency identification. A birdie-bypass marker system is used to provide accurate marker placement. The VS-20 has many additional features including manual sweep and external leveling capability.

The transistors used are all silicon and the low frequency circuits are assembled on high-quality printed circuit boards for maximum reliability and serviceability.

The VS-20 covers the frequency range of 500 Hz to 25 MHz in one band. A block diagram of the sweep system is shown in Figure 2-1. The sweep frequency is derived by taking the low level heterodyne output of two buffered oscillators and amplifying this output to 1.0V rms. Low level mixing is employed to maintain a low spurious output signal. The RF output is sampled and detected in the monitor block. This sample is amplified in the leveler circuitry, compared to a stable reference voltage, and the error voltage used to automatically alter the leveled B+ to compensate for RF output level changes. The leveling is done on the amplifiers to eliminate oscillator frequency shift with level changes. This electronic servo system provides automatic leveling which maintains the sweep output flat to within $\pm$0.25 dB.

The same monitor system provides a sample of the RF signal for use in the birdie-bypass marker system. Markers are obtained by mixing the sweep sample with a CW source and amplifying a narrow band of frequencies around the resultant zero beat. These markers can be conveniently added to the detected output of the unit being tested by using the adder provided in the unit.

The VS-20 is provided with a wide range of output attenuation capability: an RF vernier attenuator with a 6-dB range, and a 1-dB step attenuator providing up to 108 dB of continuously variable output attenuation.

The variable sweep rate is possible because the unit is electronically swept with a varactor diode used as the voltage sensitive element of the sweep oscillator. The drive for the varactor is derived from a sawtooth

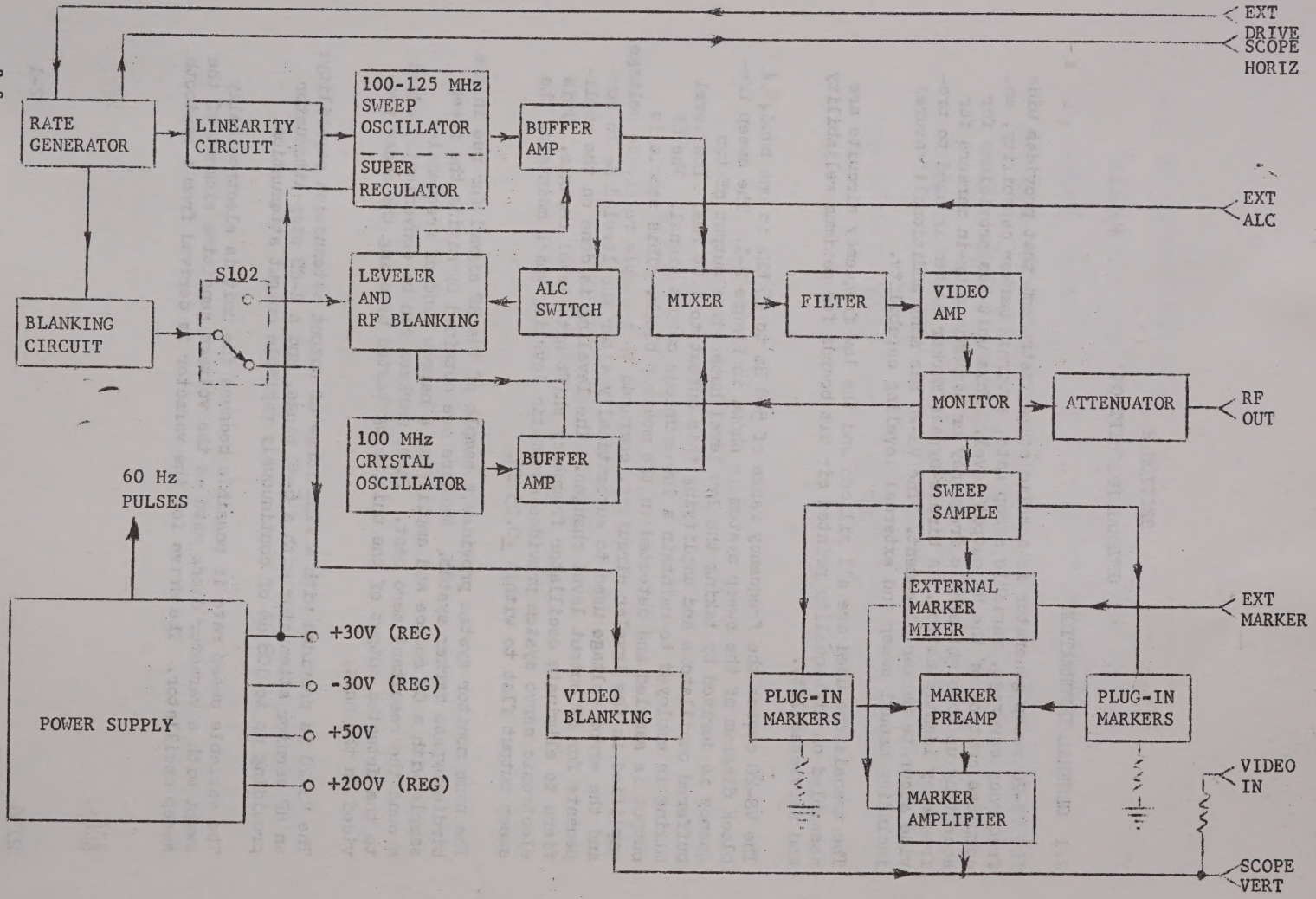


FIGURE 2-1: VS-20 BLOCK DIAGRAM

generator and a nonlinear shaping circuit. The sawtooth waveform is reshaped to compensate for the nonlinear voltage-versus-capacitance characteristic of the varactor, thereby providing a linear frequency change with time.

2.2 INTRODUCTION

The block diagram of the VS-20, shown in Figure 2-1, can be divided into four major sections: (1) sweep drive, blanking, and leveling circuits, (2) sweep oscillator, CW oscillator, mixer, and video amplifier, (3) power supply, and (4) marker circuits. The following paragraphs present a description of the circuit details of each of these sections.

2.3 SWEEP DRIVE, BLANKING, & LEVELING CIRCUITS

The schematic for this circuitry is shown in Figure 6-2. This circuit provides the preshaped sweep drive signal, the blanking signal for video and RF modes, and leveled B+. This circuit can be subdivided into sections: (1) the rate circuit, (2) linearity circuit, (3) blanking circuits, and (4) the leveling (ALC) circuit.

2.3.1 Rate Circuit

The rate circuit has five modes of operation. These five modes are achieved by changing the operating characteristics of the basic rate generator which consists of a Schmitt trigger and a Miller integrator.

The bistable Schmitt trigger consists of Q101 and Q102, and associated resistive networks. The output at the collector of Q102 is a square-wave signal which is coupled to the blanking circuits and to the Miller integrator.

The Miller integrator consists of Q103 and Q104, and associated resistor and capacitor networks. The output at the collector of Q104 is a triangular wave signal. The free-running condition is established by coupling the output of Q104 to the input of the Schmitt trigger. The output at the collector of Q104 is coupled to the linearity circuit through emitter follower, Q105.

Sweep rate switch, S103, a front panel control, is used to select the desired mode of operation. In the line position, the 50/60 Hz line signal is derived from power transformer, T1, and a network consisting of R25, VR8, and parallel capacitors, C101 and C106. The line synchronizing signal is coupled to the base of Q101 through S103 and R111. Other poles of S103 convert circuit time constants to insure locking in the line mode.

In the 5 to 60 Hz and the 0.05 to 5 Hz positions, the trigger-integrator combination is free-running. The sweep rate may be continuously adjusted

by R120B or R120C, the front panel vernier control. In each case, the respective time constants (R118, R120B, and C102 for the 5 to 60 Hz rate; and R117, R120C, and parallel capacitors, C102 and C103 for the 0.05 to 5 Hz rate) determine the generator sweep rate.

In the manual and external modes, the trigger and integrator are inoperative. In the manual mode, the sweep drive and horizontal oscilloscope drive voltages are determined by the setting of R120A in the voltage divider consisting of R123, R120A, and R127. R120A is ganged to R120B, and R120C, the front panel vernier adjustment. In the external position, an external generator may be used in place of the internal rate circuit.

2.3.2 Linearity Circuit

The linearity circuit provides a linear frequency-versus-voltage characteristic in the RF output display at all sweep width settings, and over the full frequency range of the VS-20. The sweep drive circuit amplifies and reshapes the input triangular-wave signal to achieve the linear RF output.

The triangular-wave signal from the rate generator is coupled to emitter follower, Q105. Three outputs are coupled from separate voltage dividers at the emitter of Q105. One of these outputs is the oscilloscope horizontal drive, a triangular-wave signal.

The other two outputs are coupled to common-base transistor circuits: linear amplifier, Q106, and nonlinear amplifier, Q107. The nonlinear amplifier characteristics are controlled by the diode break circuit consisting of resistors R136 through R146, diodes CR104 through CR113, and resistors R148 through R157. As a positive going signal is applied to the emitter of Q107, the individual diodes are reverse-biased, but as the Q107 collector voltage increases, individual diodes conduct in sequence, and the output is reshaped by the nonlinear, diode break circuit.

The outputs of the linear and nonlinear amplifiers are coupled to the front panel sweep width switch and potentiometer combination, S101 and R164A and R164B. The two combined output signals from the common-base amplifiers, and the resistive networks maintain RF sweep linearity under all conditions of sweep width and frequency. The resultant drive signal is coupled to the varactor diode, CV502 in the sweep oscillator.

2.3.3 Blanking Circuits

The blanking circuits in the VS-20 reduce the displayed vertical signal to a zero baseline during the sweep retrace. Two blanking modes, RF and video, are controlled from internal slide switch, S102, located on the main printed circuit board. (See Figure 6-5.) The Schmitt trigger generates the blanking pulses. In RF blanking, the RF output is blanked during retrace. Q204 and Q203 saturate, Q201 is cut off, and the leveled B+ to the sweep oscillator buffer amplifier, and to the crystal oscilla-

tor buffer amplifier are both blanked. As a result, the RF output is blanked during the retrace period.

In the video blanking position of S102, the blanking signal is coupled to the gate of JFET Q109, an electronic switch which shorts the oscilloscope vertical connector J309 to ground during the retrace interval. The unit is normally shipped in the video blanking position.

Selection of video or RF blanking depends on the particular application of the sweep generator. NOTE: If the detected signal of the device under test is coupled to the vertical oscilloscope input, and not as shown in Figure 3-2, the typical test setup, video blanking does not occur. Experience of the operator may dictate the choice of blanking mode.

2.3.4 Leveling (ALC) Circuit

The leveling circuit, or leveler, functions as a DC voltage regulator which supplies controlled B+ voltage to each of two buffer amplifiers (see paragraph 2.4). One buffer amplifier controls the amplification of the sweep oscillator RF output signal. The other buffer amplifier controls the amplification of the 100 MHz crystal oscillator.

The leveler is part of the automatic control (ALC) circuit which provides a constant RF output voltage at the output of the video amplifier, the monitor point.

A negative detected voltage is coupled from the cathode of CR605, the monitor point, to the base of transistor, Q206, the sampling input of the differential amplifier. A stable, but adjustable bias voltage is coupled to the base of Q207, the reference-half of the differential amplifier. Any difference between the negative monitor voltage sample, and the pre-set reference voltage appears at the collector of Q206 as an amplified, phase-inverted error signal. The Q206 collector output is further amplified and phase inverted by Q202. The collector output of Q202 is coupled to the base of emitter follower Q201. The output of the emitter follower supplies corrected B+ to the two buffer amplifiers. The error signal is coupled through the remainder of the control loop consisting of the buffer amplifiers, the mixer, the filter, and the video amplifier. The corrected signal arriving at the monitor point compensates for the initial error, and restores the RF output to the desired level. Capacitors, C201 through C204, stabilize the leveler.

The DC reference point in the ALC circuit, the base of Q207, can be adjusted from the front panel vernier control, R208. With R209 and R210 factory adjusted, the RF output voltage can be continuously adjusted over a 10 dB range.

Front panel switch, S201 bypasses the internal monitor and couples the front panel, external ALC connector J201 to the base of Q206. The VS-20 may be leveled from a remote location if an external voltage monitor (Texscan EM-50) is used.

2.4 SWEEP OSCILLATOR, CW OSCILLATOR, MIXER, & VIDEO AMPLIFIER

The two oscillators, two buffer amplifiers, mixer, filter, and video amplifier are shown in Figure 6-3. The sweep oscillator, an inductance tuned, varactor swept oscillator using transistor, Q505, is tunable over the range of 100 MHz to 125 MHz. The oscillator sweeps through the same 100 to 125 MHz range. The sweep drive voltage for this oscillator is coupled to the varactor, CV502. The sweeping action changes the capacitance of the oscillator tank circuit, and provides the required sweep frequency range.

The stability of the VS-20 is improved by using buffer amplifiers at the output of each oscillator, and by "super-regulating" the sweep oscillator B+ voltage with an additional stage of DC regulation. The second regulator is driven by the +30 volt regulator, and is contained in the sweep oscillator enclosure. The super-regulator consists of transistors, Q501 through Q504, and voltage reference zener, VR502. The operation of this supply is identical to the +30 volt regulator in the main power supply (see paragraph 2.5). The close proximity of the additional regulating stage to the sweep oscillator reduces the ripple to a low value. The RF output of the sweep oscillator is coupled to the buffer amplifier through C512 and R509.

The buffer amplifier transistors, Q506 through Q509, which amplify the sweep oscillator output are connected in common emitter, emitter follower pairs to achieve high gain, stable high frequency amplification. The buffer amplifier is untuned to improve stability.

The CW oscillator is a 100 MHz crystal oscillator consisting of transistor Q601, a crystal Y601, and an associated circuit. This oscillator is coupled from a loop terminated with R608 and R609 to the crystal oscillator buffer amplifier.

The outputs of the two buffer amplifiers are coupled to the mixer stage. The mixer consists of bridge diodes, CR601 through CR604. The mixer is operated at low signal levels within the square-law region to produce a low spurious output signal. The output of the mixer is coupled to a low-pass filter with tunable inductors L604 through L608.

The filter output is coupled to the video amplifier. The video amplifier is similar to the sweep oscillator buffer amplifier. Large coupling capacitors are required to provide the low frequency response. Two stages of common emitter, emitter follower transistor amplifiers are used. The output of the video amplifier is 1.0 volt rms into an external 50 ohm load.

The output of the video amplifier is monitored by CR605 as described in paragraph 2.3.4. Any change in RF output voltage is automatically corrected by the ALC system. Since a constant RF voltage is maintained at the monitor point, this point is a zero impedance, constant voltage point. Therefore, Z604 is the source impedance of the sweep generator, namely, 50 ohms.

A sample of the RF for use in the marker circuitry is coupled from the monitor point through R629. This sample of the output signal is necessary for production of markers in the birdie-bypass system. This output is fed to the sweep sample divider (see Figure 6-4).

The output of termination Z604 is coupled to the rocker switch attenuator Z603 to the front panel connector, J605. Attenuation in 1.0 dB steps up to 102 dB may be selected from Z603. In addition, the RF vernier provides a continuous adjustment of 6 dB.

2.5 POWER SUPPLY

The DC power supply schematic diagram for the VS-20 is shown in Figure 6-1 of Section 6. The supply provides regulated +30V, +200V, and -30V sources, and a +50V unregulated power source. Power transformer, T1 can be wired for either 115V or 230V, 50/60 Hz input voltages. The units are normally wired for 115V, but may be changed to 230V operation by revising the jumper connections shown in Figure 2-2.

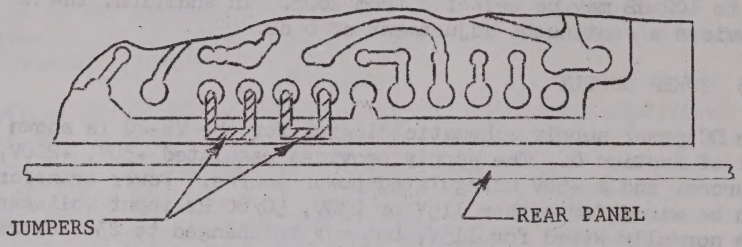
In addition to the DC outputs, 60 Hz line pulses are supplied from the secondary of T1 through R25 and zener diode VR8. This resistor-diode network reduces the effects of line voltage transients. The pulses provide a constant output to synchronize the 50/60 Hz line sweep rate mode.

The unregulated +50V output is obtained from the fullwave rectifier, CR2 and CR6, and an RC filter consiting of R1, C1C, and C2.

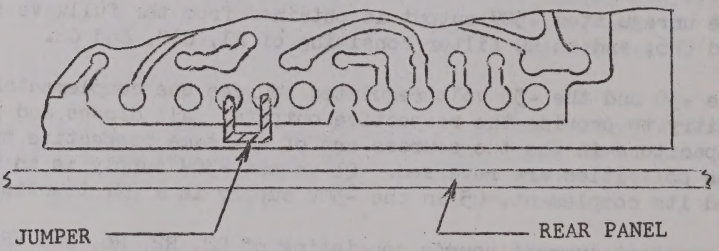
The +30 and the -30 volt regulated sources use complementary circuitry to provide the respective outputs. All diodes and polarized capacitors in the two sources are of the same respective types except the polarities are reversed. Q1 in the +30V supply is an NPN transistor, and its complement, Q5 in the -30V supply is a PNP transistor.

A constant-current source consisting of Q2, R2, R6, and VR1 supplies the base of pass-transistor Q1, and the collector of Q4. Any change in the output voltage is sensed in the voltage divider R5, R7, and R8. It is compared to the reference voltage across zener diode VR3, and temperature-compensating diode CR7, and then differentially amplified in Q4. Q4 drives the base of pass-transistor Q1 so that the collector-to-emitter voltage change opposses the change in output voltage, and returns the output to normal value. C6 filters noise in zener diode VR3. C4 provides feedback to eliminate high fre-

MAIN P-C BOARD
BOTTOM VIEW



115-VOLT CONNECTIONS



230-VOLT CONNECTIONS

NOTE:

Units shipped from the factory are identified for operation from the proper power source. Internal connections are made as shown for each input. Each input power source is identified as follows:

115-volt rms, 50/60 Hz, single-phase power
A YELLOW label marked "115V" is affixed to the power cord within six inches of the power plug, and to the rear panel of the instrument.

230-volt rms, 50/60 Hz, single-phase power
A RED label marked "230V" is affixed to the power cord within six inches of the power plug, and to the rear panel of the instrument.

quency instability. R3 and Q12 protect the circuit from overload. The output ripple of the +30V supply is typically 6 mV, and regulation is maintained with a 10 percent line voltage change. The output ripple of the -30V supply is typically 4 mV.

The +200V regulator is supplied from fullwave-rectifier CR1 and CR4. The reference voltage is obtained from I2 at 82 volts. The +200V regulated source is similar to the +30V source except a constant-voltage source consisting of R16, R18, and VR7 supplies the base of Q10 and the collector of Q11. This regulated DC voltage has a typical output ripple voltage of 3 mV.

2.6 MARKER CIRCUITRY

The unit is supplied with a birdie-bypass system (Figure 6-4 of Section 6), which has an external marker input plus provision for eight plug-in single frequency (SM) or harmonic (HM) markers. In the marker system, a sample of the swept RF signal is mixed with the fundamental or harmonic of the plug-in markers to produce beatnotes or birdies. These beatnotes or birdies are then amplified, shaped, and added to the demodulated video signal. The combined signal is coupled to the vertical channel of the display oscilloscope.

The sweep sample from the video amplifier output is divided to provide two coupled signals to the marker circuitry. When an external CW source is used as a marker, the signal is fed into a diode mixer, CR351, where it is mixed with the sweep sample from R355. The signal is then fed to the external marker amplifier Q306, a high-gain, common-emitter amplifier.

R331 is a front panel external marker size control which allows the external marker system to accept a wide variation in signal source amplitudes.

The plug-in marker system consists of eight plug-in receptacles. Each plug-in receptacle has its own internal size adjustment. The markers produced in each plug-in can be independently controlled in amplitude with potentiometers, R305, R306, R311, R312, R317, R318, R324, and R325. This allows each marker to be adjusted to a different amplitude and gives quick and easy identification of the various markers on the oscilloscope display.

There are four amplifier stages built on the plug-in marker printed circuit board. Each amplifier stage is fed from two plug-in marker receptacles. The outputs of all four amplifier stages are fed through a common-emitter amplifier Q305. The plug-in marker signals and the external marker signal from Q306 are coupled to a marker shaper network. The marker shaper network consists of C307, C308, C309, C310, C311, C315, C316, C317, L301, R334, R335, R342, and R343. The shaped marker is further amplified by the common birdie amplifier Q307.

After amplification, the markers are applied to the marker size potentiometer, R339, which is a front panel adjustment, and become available at the oscilloscope vertical output connector on the front panel.

The connection of the sweep sample cables to the plug-in markers is shown in Figure 2-3.

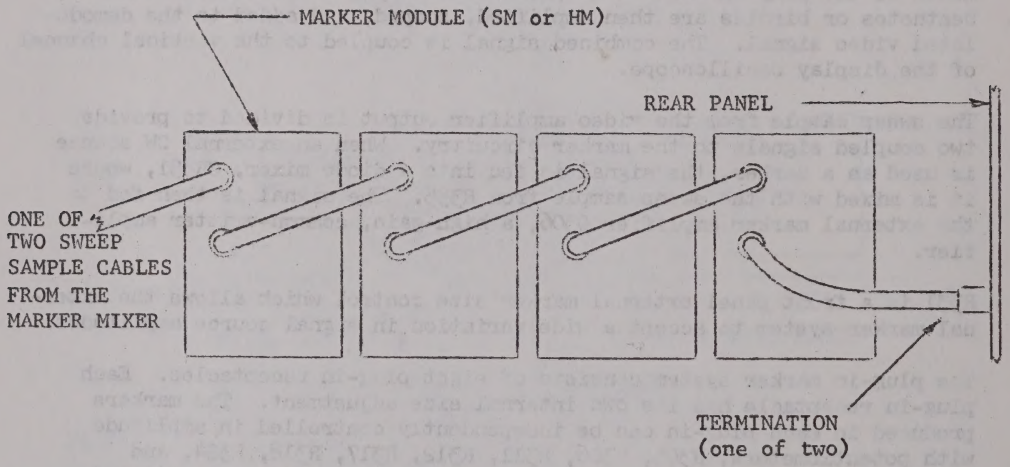


FIGURE 2-3

PLUG-IN MARKER HOOKUP
(ONE OF TWO ROWS SHOWN)

SECTION 3

OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The VS-20 is a versatile, wide range sweep generator which incorporates the latest sweep techniques. It can be employed as a CW source as well as a sweep generator. Most of its operating features can be easily understood from a description of the front panel controls. This unit is supplied for operation from a 115 volt, 50/60 Hz power source, but can be supplied for 230 volt operation (see Figure 2-2).

3.2 DESCRIPTION OF FRONT PANEL CONTROLS

A drawing of the front panel of the VS-20 is shown in Figure 3-1. An identification of each control and its function is as follows:

3.2.1 Center Frequency Dial

Indicates the frequency of the oscillator in the CW modes and at minimum sweep width in the sweep modes. This control consists of a direct and vernier drive for coarse and fine frequency adjustments. The vernier provides approximately 160 times reduction in sensitivity compared to the coarse control.

3.2.2 Power Switch

Switches on the line voltage to the unit.

3.2.3 Sweep Width Control

This potentiometer and switch combination is used to vary the sweep width of the output and to select the CW mode of operation.

3.2.4 External ALC Connector

The ALC signal from an external monitor, if used, is inserted here.

3.2.5 External Marker Connector

This connector allows an external signal source to be inserted to provide a marker on the video output.

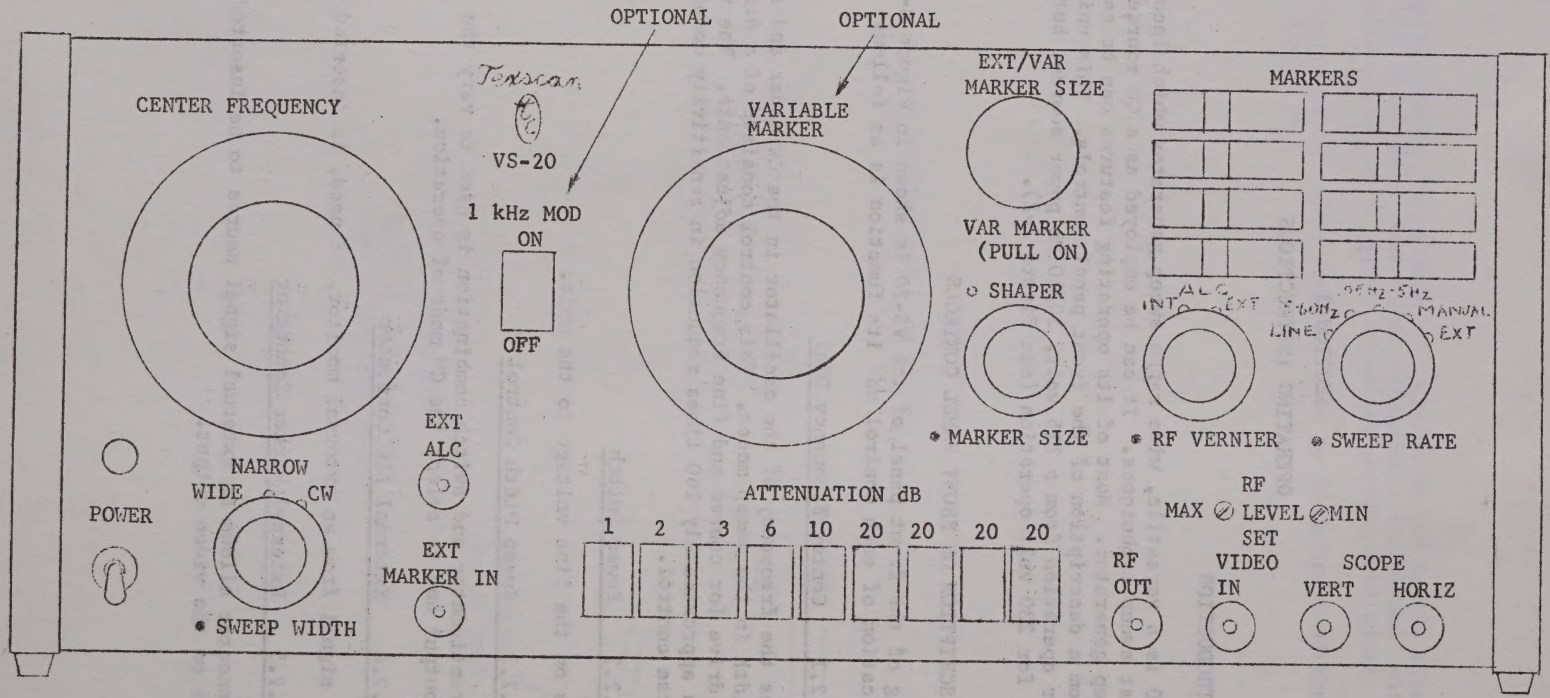


FIGURE 3-1: FRONT PANEL LAYOUT

3.2.6 Attenuation

The rocker switch attenuator can be used to control the amplitude of the RF output by 102 dB in 1 dB increments.

3.2.7 External Marker Size Control

Provides adjustment of the amplitude of the external marker, if used.

3.2.8 Fixed Marker Size & Shaper

This dual control varies the size of all birdie markers, both plug-in SM or HM markers and external markers. The shaper can be used to vary the bandpass of the birdie amplifier and, subsequently, narrow or widen the birdie marker width.

3.2.9 Marker Switches

These switches are used to turn on or off any plug-in marker employed.

3.2.10 ALC Switch & RF Vernier

The ALC (automatic leveling control) switch can be used to switch from normal operation to external leveling. When in the EXT position, the RF level set potentiometers must be adjusted and an external monitor signal must be provided of sufficient amplitude or the unit will not meet its flatness specifications. The RF vernier provides continuously variable adjustment of the RF output level over a 6 dB range. For normal operation below 100 kHz, the ALC switch must be in the external position to prevent the ALC circuit from distorting the RF output signal.

3.2.11 Sweep Rate Control

This potentiometer and switch combination provides control of the rate at which the RF output is swept. Five modes are provided: (1) Line; 50/60 Hz sweep rate, (2) Variable; 5 to 60 Hz continuously variable, (3) Variable; 0.05 to 5 Hz continuously variable, (4) Manual; center knob can be used to manually sweep the unit, and (5) External; an external source may be employed to sweep the RF oscillator.

3.2.12 RF Level Set Potentiometers

Two potentiometers are provided on the front panel to set the maximum and minimum output power levels which can be obtained by varying the RF vernier control. These potentiometers are set at the factory for proper operation with the internal monitor system. They are provided as front panel controls so that if an external monitor is employed, these levels can be reset.

3.2.13 RF Out Connector

Connector for swept or CW output.

3.2.14 Video In Connector

The detected RF from the device under test is inserted here to superimpose birdie markers on the detected signal.

3.2.15 Scope Vertical

The detected RF signal with markers superimposed is available at this connector for connection to the oscilloscope vertical channel.

3.2.16 Scope Horizontal

The oscilloscope horizontal drive signal is available at this connector.

3.3 DESCRIPTION OF REAR PANEL CONTROLS

3.3.1 External Sweep Drive Connection

An external sweep drive signal can be inserted here.

3.4 TYPICAL TEST SETUP

Make connection to the oscilloscope, device under test, detector, and sweep generator as shown in Figure 3-2.

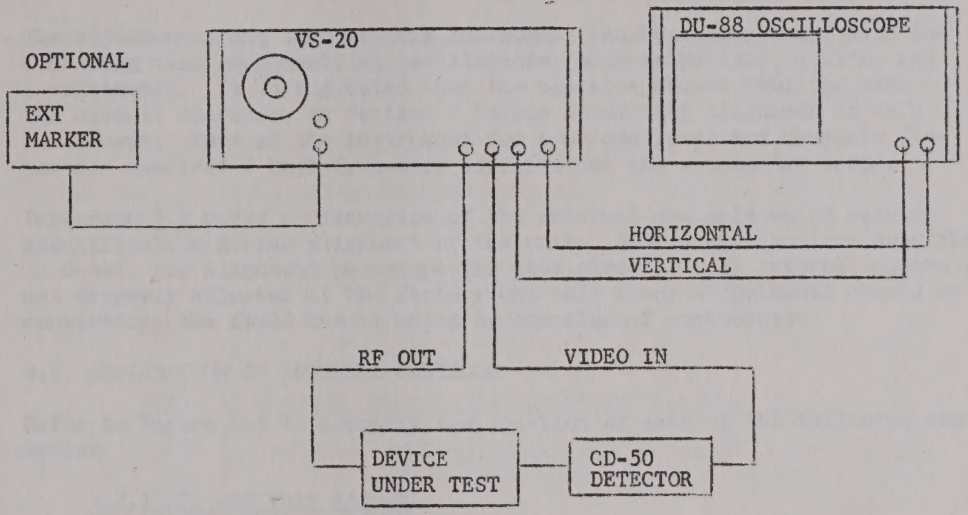
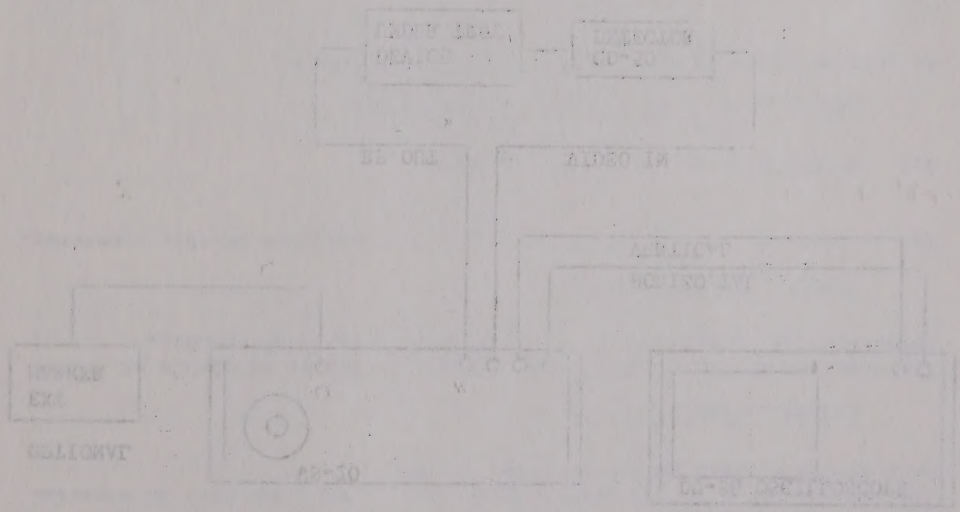


FIGURE 3-2

TYPICAL TEST SETUP

This is the setup for measurement of bandpass characteristics and is the most widely used application for sweep generators. NOTE: While making measurements below 100 kHz, the monitor switch should be in the external position (no ALC action).



SECTION 4

ADJUSTMENT PROCEDURE

4.1 INTRODUCTION

The adjustments and test of this instrument can be accomplished with the following test equipment; an oscilloscope (such as HP-130), a VTVM, and a multimeter. It is suggested that the operator become familiar with the circuit operation in Section 2 before attempting alignment of this instrument. Test of the instrument for spurious level and harmonic distortion requires a high frequency oscilloscope and a sampling scope.

Paragraph 4.2 gives a discussion of the internal controls which require identification during alignment of the unit. Subsequent sections describe in detail the alignment procedure for each circuit. All internal controls are properly adjusted at the factory and only minor adjustments should be required in the field due to aging or changing of components.

4.2 EXPLANATION OF INTERNAL CONTROLS

Refer to Figure 6-5 to identify the location of each of the following controls:

4.2.1 R7, +30 Volt Adjust

Adjusts the output voltage of the +30 volt power supply.

4.2.2 R14, -30 Volt Adjust

Adjusts the output voltage of the -30 volt power supply.

4.2.3 R21, +200 Volt Adjust

Adjusts the output voltage of the +200 volt power supply.

4.2.4 R101, Upper Trigger Point Adjust

Adjusts the upper trigger point for the Schmitt trigger in the rate generator.

4.2.5 R106, Line DC Level Adjust

Adjusts the DC level of the rate generator output voltage in the line rate mode of operation so that it is equal to the DC level in the variable rate mode.

4.2.6 R108, Lower Trigger Point Adjust

Adjusts the lower trigger point for the Schmitt trigger in the rate generator.

4.2.7 R119, Line Trigger Amplitude Adjust

Adjusts the amplitude of the rate generator output voltage in the line rate mode of operation so that it is equal to the amplitude in the variable rate mode.

4.2.8 R131, Medium Sweep Width Center Frequency Adjust

Adjusts the DC level of the linearity drive voltage and is used to adjust center frequency at medium sweep width.

4.2.9 R159, Wide Sweep Width Limit Adjust

Adjusts the linearity drive voltage and is used to set the maximum sweep width limit.

4.2.10 R161, High Sweep Width Center Frequency Adjust

Adjusts the DC level of the linearity drive voltage and is used to adjust center frequency at wide sweep width.

4.2.11 R305,R306,R311,R312,R317,R318,R324,R325; Marker Size Adjustments

These controls provide individual adjustment of the marker size available from plug-in marker receptacles one through eight.

4.2.12 R504, Sweep Oscillator B+ Adjust

Adjusts the voltage level of the sweep oscillator collector voltage (located in sweep oscillator assembly).

4.2.13 S102, Blanking Selector Switch

This switch provides the choice of video blanking (normal), or RF blanking.

4.3 POWER SUPPLY

4.3.1

With the polarized plug of the unit connected to the AC power line, and the power switch on, monitor the -30V DC point with an accurate voltmeter and a high gain AC coupled oscilloscope at the cathode (band) of VR5.

4.3.2

Adjust R14, the -30V DC adjust potentiometer for a -30V DC level. The AC ripple, viewed on the scope, should be approximately 4 mV peak to peak.

4.3.3

Connect the meter and scope to the anode of VR2, and adjust R7 for a +30V DC level. The ripple should be 6 mV peak to peak or less.

4.3.4

Connect the meter and the scope to the anode of VR7, and adjust R21 for a +200 volt level. The ripple should be approximately 3 mV peak to peak.

4.4 RATE GENERATOR

4.4.1

To align the rate generator, perform the following operations:

4.4.1.1

Connect the oscilloscope and a negative output RF detector as indicated in Figure 3-2, but omit the device under test.

4.4.1.2

Set the sweep rate function switch (S103) to manual position.

4.4.1.3

Turn the sweep rate vernir control (R120), from one extreme to the other. Adjust the horizontal gain and horizontal position controls of the oscilloscope so the dot on the CRT centers on the extreme left hand side, vertical reticule when the sweep rate vernier control is in the fully counter clockwise position; and on the extreme right hand, vertical reticule, when the potentiometer is in the fully clockwise position. This change should be approximately -7V to +7V, and minimum of -5V to a minimum of +5V.

4.4.1.4

Set the sweep rate function switch (S103) to either of the variable positions.

4.4.1.5

The dot should be viewed on the oscilloscope as drawing a rectangular pattern. Adjust the lower trigger point control (R108) so that the lower

left hand corner of the rectangle falls on the extreme left hand vertical reticule. Adjust the upper trigger point control (R101) so that the lower right hand corner of the rectangle falls on the extreme right hand vertical reticule. There is some interaction between these two controls and it will be necessary to "rock" in the adjustments by alternately adjusting R101 and R108 until the proper display is obtained.

4.4.1.6

Set the sweep rate function switch (S103) to line position.

4.4.1.7

Adjust the line trigger amplitude control (R119) and the line DC level control (R106) until the same pattern as noted in 4.4.1.5 is obtained. It will be noted that these two controls also interact with one another.

4.4.1.8

If any of the preceding steps cannot be completed, refer to Section 5 for trouble shooting procedures.

4.5 LINEARITY CIRCUIT

4.5.1

The unit is provided with no internal controls to adjust linearity, but the sweep width of this unit can be adjusted by performing the following operations:

4.5.1.1

Connect the unit to the oscilloscope as indicated in the typical test setup, Figure 3-2, but omit the device under test.

4.5.1.2

The best method to use when adjusting sweep width requires a 5 MHz harmonic marker (HM-5). If another harmonic marker is available, it can be employed with note taken of the changes required in the following procedure.

4.5.1.3

If a 5 MHz harmonic marker is used, set the center frequency adjustment knob to 12.5 MHz. Adjust the oscilloscope horizontal gain for 10 cm of horizontal deflection.

4.5.1.4

Advance the sweep width potentiometer front panel control to full sweep width. Adjust R159 and R161 for centering of 12.5 MHz and 25 MHz sweep. width.

4.5.1.5

Slowly decrease sweep width and adjust R131 to maintain centering of 12.5 MHz.

4.6 RF LEVEL ADJUSTMENT

4.6.1

With the same setup as used in paragraph 4.5, set the RF vernier for maximum output.

4.6.2

Being certain that the monitor switch is set for internal monitoring, adjust the maximum level potentiometer for 1.2 volt deflected output level as noted from the oscilloscope calibrated dispaly, using a Texscan CD-50 detector.

4.6.3

Switch in 6 dB of attenuation and note the vertical deflection on the oscilloscope.

4.6.4

Rotate the RF vernier for minimum output, remove the 6 dB of attenuation, and adjust the minimum level potentiometer for the same level of detected output as noted in 4.6.3.

4.7 MARKER SIZE

4.7.1

Individual marker size controls are provided, as well as the front panel control, so that if a complicated set of markers are employed, their relative sizes can be set for easy identification.

4.7.2

For example, if 5 MHz, 1 MHz and 0.1 MHz harmonic markers are all used with the front panel fixed marker size control about 3/4 clockwise,

adjust the internal control for the HM-5 for 0.2V birdies, the HM-1 for 0.1V, and the HM-.1 for 0.05V, producing an easily identified display.

4.7.3

The fixed marker size control must be set for large marker size before adjusting the external marker size control. When testing the external marker function, be sure to have the fixed marker size control set for maximum size.

4.8 SWEEP OSCILLATOR, MIXER, BUFFERS, & VIDEO AMPLIFIER

These circuits are such that adjustment of internal controls to realign is impractical. They are designed to require no adjustment in the field. These circuits should only be investigated when trouble shooting procedures have isolated a problem to the high frequency circuits.

4.9 SPURIOUS CONTENT & HARMONIC DISTORTION

4.9.1

The simplest way to determine the distortion and harmonic content level is with a high frequency oscilloscope (i.e. a Tektronix 547 and 1A1 head).

4.9.2

Set the VS-20 for CW operation near 500 Hz. It is necessary when operating below 100 kHz that the automatic leveling circuits are not achieved. This is easily accomplished by switching the monitor switch to external.

4.9.3

Connect the RF output to a high frequency oscilloscope (i.e. Tektronix 547 with 1A1 head), and adjust the oscilloscope for a 6 cm vertical display.

4.9.4

Adjust the time base of the oscilloscope for one or two cycles of RF and note the deviation from a sinewave.

4.9.5

Vary the center frequency of the unit between 500 Hz and 25 MHz and note the distortion. Above 100 kHz, the monitor switch should be in the internal position.

4.9.6

If the unit meets its shipping specifications, the distortion determined with the following equation will be less than 5 percent.

4.9.7

Given the presentation shown in Figure 4-1, the distortion can be obtained by calculating $\frac{A-B}{A+B}$ = % Distortion.

4.9.8

Adjust the high frequency oscilloscope time base for at least 10 cycles of RF and note if any lower frequency modulation is present when the unit is tuned from 500 Hz to 25 MHz. Again, the monitor switch should be in external position (no ALC) from 500 Hz to 100 kHz and internal position from 100 kHz to 25 MHz.

4.9.9

A typical presentation is shown in Figure 4-2. The spurious level may be calculated from the equation: $20 \log_{10} \frac{A}{a}$ = Spurious level in dB.

4.9.10

If the unit is operating normally, the spurious level is typically more than 30 dB down.

FIGURE 4-1

LOW FREQUENCY DISTORTION DISPLAY

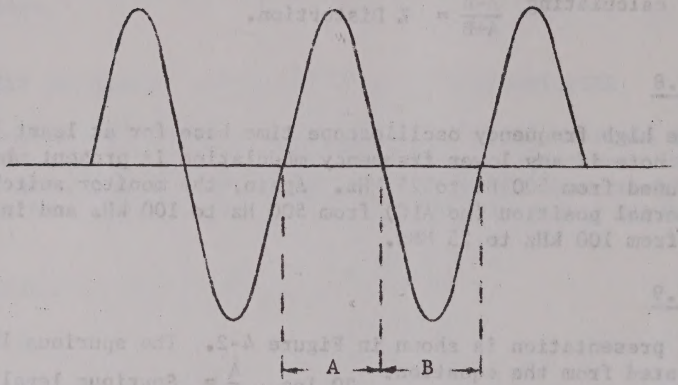
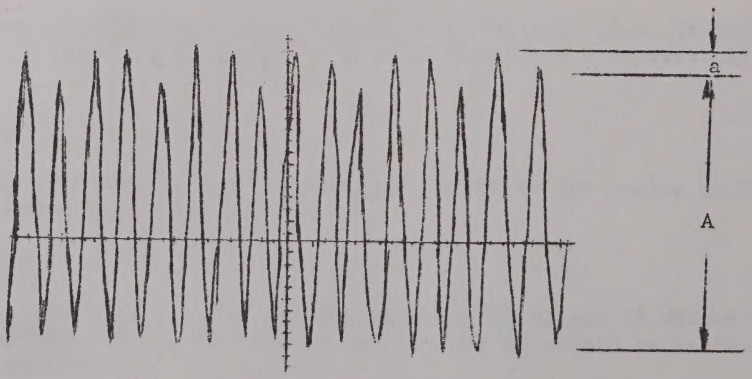


FIGURE 4-2

SPURIOUS LEVEL TEST DISPLAY



SECTION 5

MAINTENANCE

5.1 INTRODUCTION

In trouble shooting electronic equipment, the best approach is to systematically isolate the problem to a particular circuit, and then to a component by a process of elimination. Before attempting to locate a failure, it is suggested that the trouble shooting technician or engineer become familiar with the equipment by reading Sections 2 and 3 of this manual. Paragraph 5.2 presents a trouble shooting chart which lists some of the common failures. This trouble shooting chart should assist in finding or localizing the defective parts. A VTVM and an oscilloscope should be sufficient to test the unit.

5.2 TROUBLE SHOOTING CHART

SYMPTOM	CHECK
5.2.1	
Power switch on, but the pilot light does not come on.	F1 and I1.
5.2.2	
F1 blows when the unit is turned on.	C1A, C1B, C1C, C1D, C2, C7, CR1, CR2, CR3, CR4, CR5, CR6, and T1. Shorted power supply outputs.
5.2.3	
+30V not present or has excessive ripple.	C1D, C4,C5,C6,CR2,CR6,CR7,CR8,Q1, Q2,Q3,Q4,Q12,VR1, and VR3
5.2.4	
-30V not present or has excessive ripple.	C7,C8,C9,C10,CR3,CR5,CR9,CR10,Q5, Q6,Q7,Q8,Q13,VR4, and VR6.

5.2.5	
+200V not present or has excessive ripple.	C1A,C1B,C13,C14,C15,C16,Q9,Q10, Q11,I2, and VR7.
5.2.6	
+50V not present, but +30V normal.	C1C,C2, and R1.
5.2.7	
Power supply voltages will not adjust properly.	Zener diodes in respective supplies, or I2 in +200V supply, transistors.
5.2.8	
No horizontal drive, but manual sweep operates normally.	Q101,Q102,Q103, and Q104.
5.2.9	
No horizontal drive in any sweep rate position.	Q101,Q102,Q103,Q104, and Q105.
5.2.10	
Horizontal drive normal, but no RF blanking.	Q203,Q204, and VR201.
5.2.11	
Horizontal drive normal, but no video blanking.	Q109.
5.2.12	
Center frequency does not adjust.	+200V supply, Q106, and Q107.
5.2.13	
RF output will not level properly.	Max RF level control, R210 improperly set. CR605,Q201,Q202,Q206, and Q207.
5.2.14	
Insufficient or no RF output.	RF transistors, RF cables, mixer diodes, +30 volt supply, -30 volt

	supply, +50 volt supply, super-regulated supply, leveler circuit.
5.2.15	
No internal or external markers.	Q307.
5.2.16	
Internal markers normal, but external markers inoperative.	CR351 and Q306.
5.2.17	
Some internal markers normal, others inoperative, external marker normal.	Transistor for respective marker. Plug-in markers.
5.2.18	
External marker normal, but no internal markers.	Q305.

SECTION 6

DOCUMENTATION

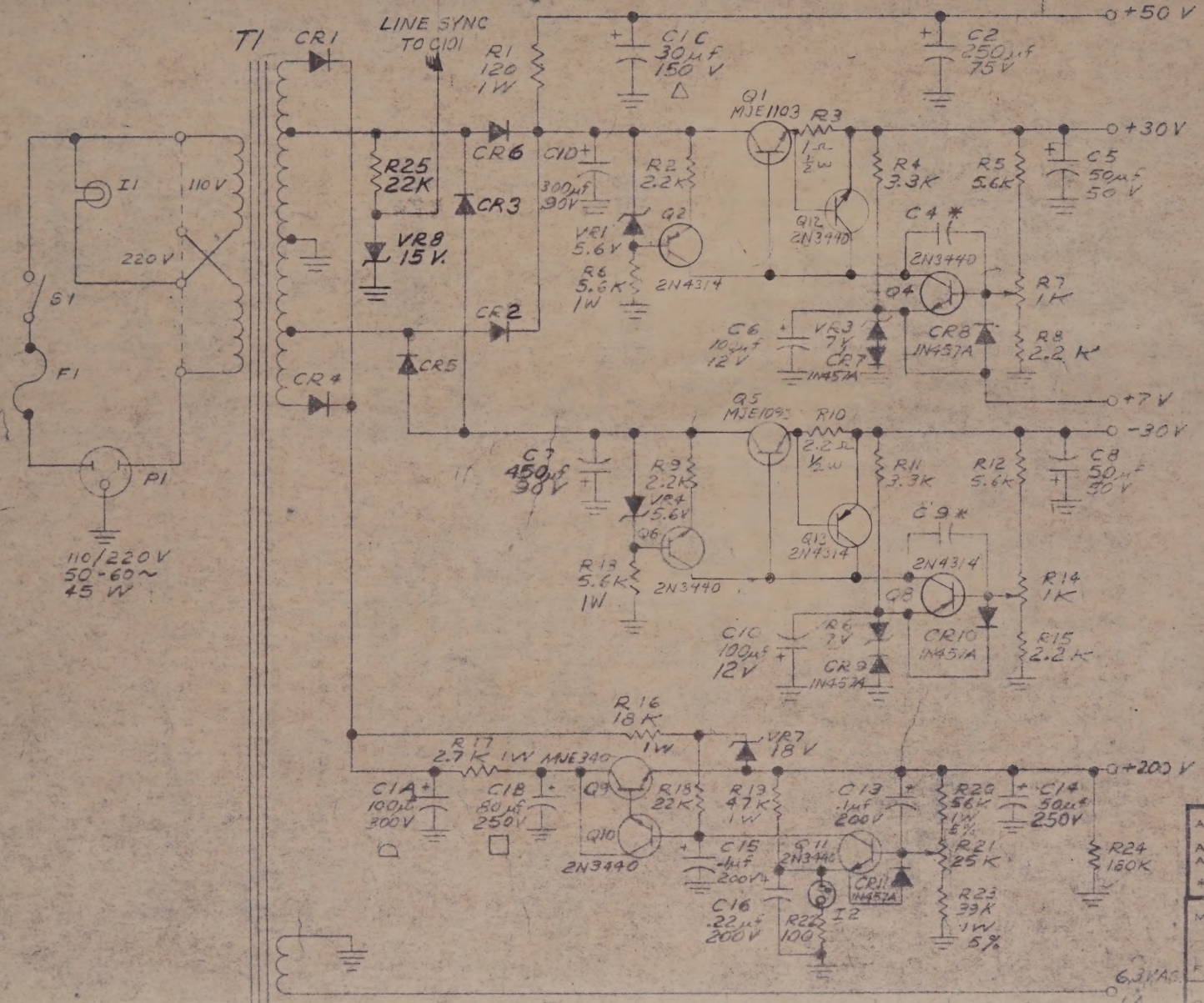
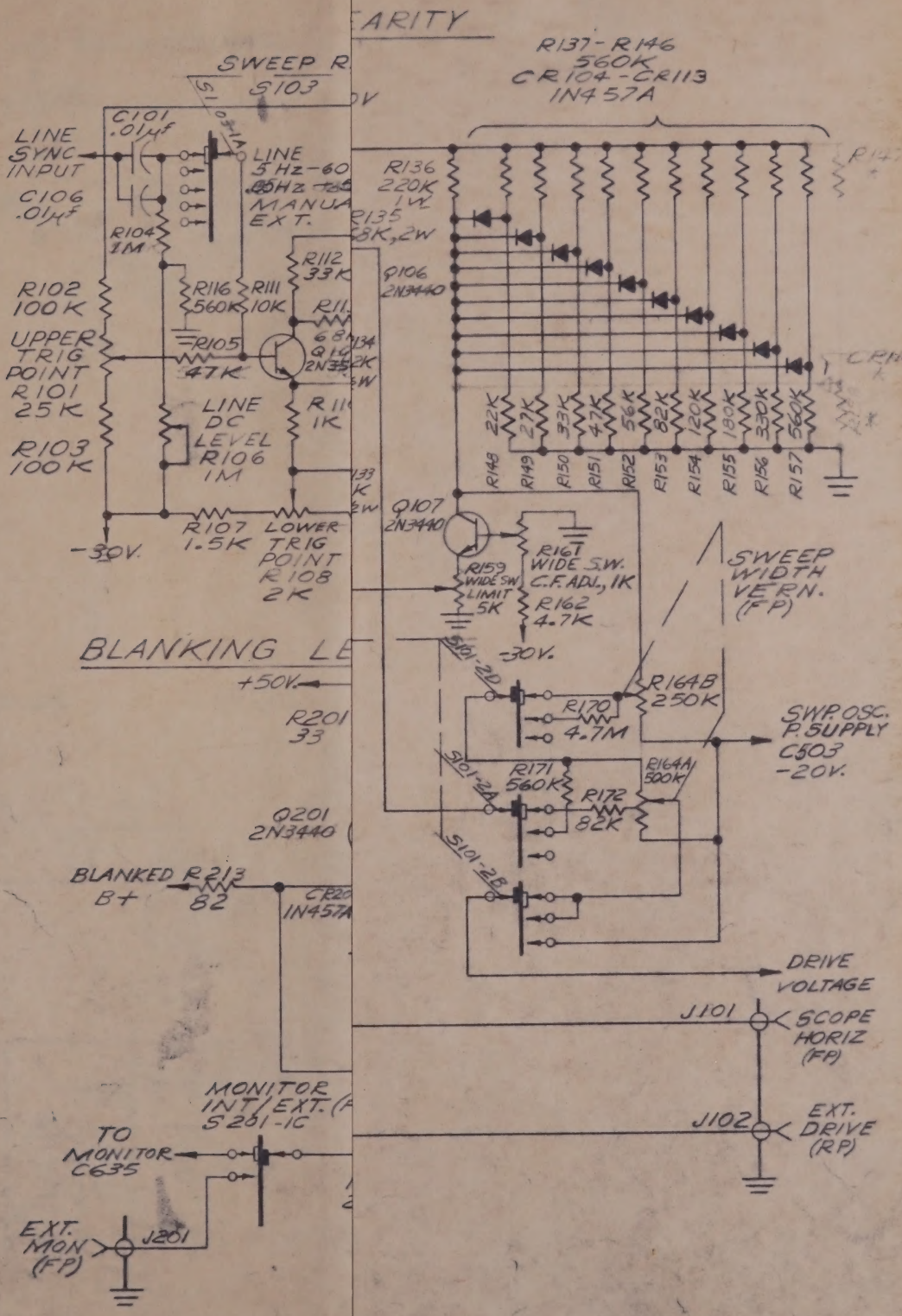


FIGURE 6-1

2182

6-1


SWEEP R
S103
C101 .01μf
LINE SYNC INPUT
C106 .01μf
LINE 5 Hz-60
MANUA
EXT.
R104 1M
R102 100K
UPPER TRIG POINT R101 25K
R103 100K
R116 560K
R111 10K
R105 47K
R112 33K
Q106 2N3440
LINE DC LEVEL R106 1M
R107 1.5K
LOWER TRIG POINT R108 2K
-30V.
R136 220K 1W
R135 8K, 2W
R137-R146 560K
CR104-CR113 IN457A
R147
CR114
R148 22K
R149 27K
R150 33K
R151 47K
R152 56K
R153 82K
R154 120K
R155 180K
R156 330K
R157 560K
Q107 2N3440
R159 WIDE SW. LIMIT 5K
R161 WIDE SW. C.F. ADJ., 1K
R162 4.7K
SWEEP WIDTH VERN. (FP)
BLANKING LE
+50V.
R201 33
S101-2D
R164B 250K
R170 4.7M
SWP. OSC. P. SUPPLY C503 -20V.
S101-2A
R171 560K
R164A1 500K
R172 82K
Q201 2N3440
S101-2B
BLANKED B+
R213 82
CR20 IN457A
DRIVE VOLTAGE
J101
SCOPE HORIZ (FP)
J102
EXT. DRIVE (RP)
MONITOR INT/EXT. (F
S201-1C
TO MONITOR C635
EXT. MON (FP)
J201

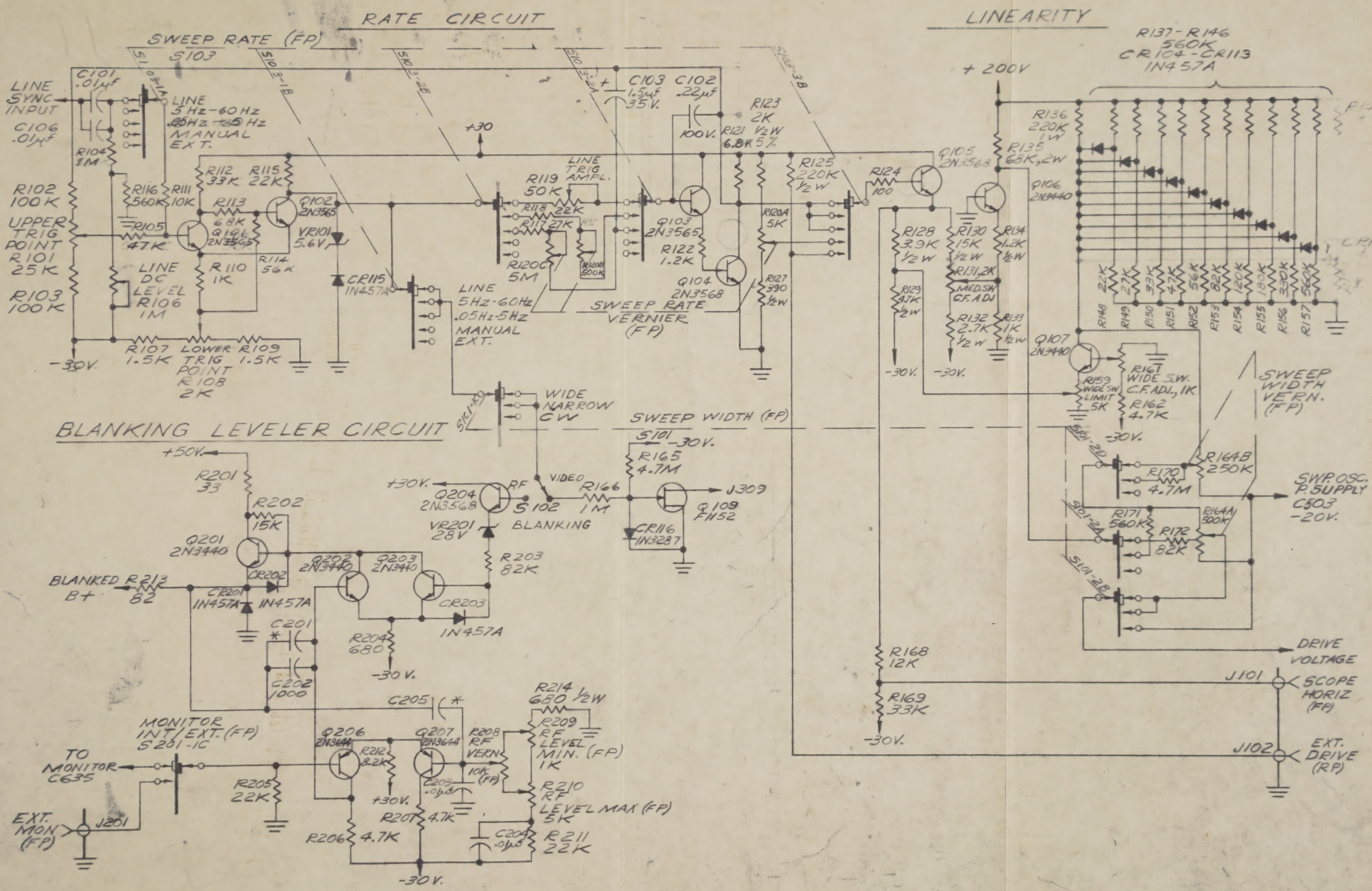
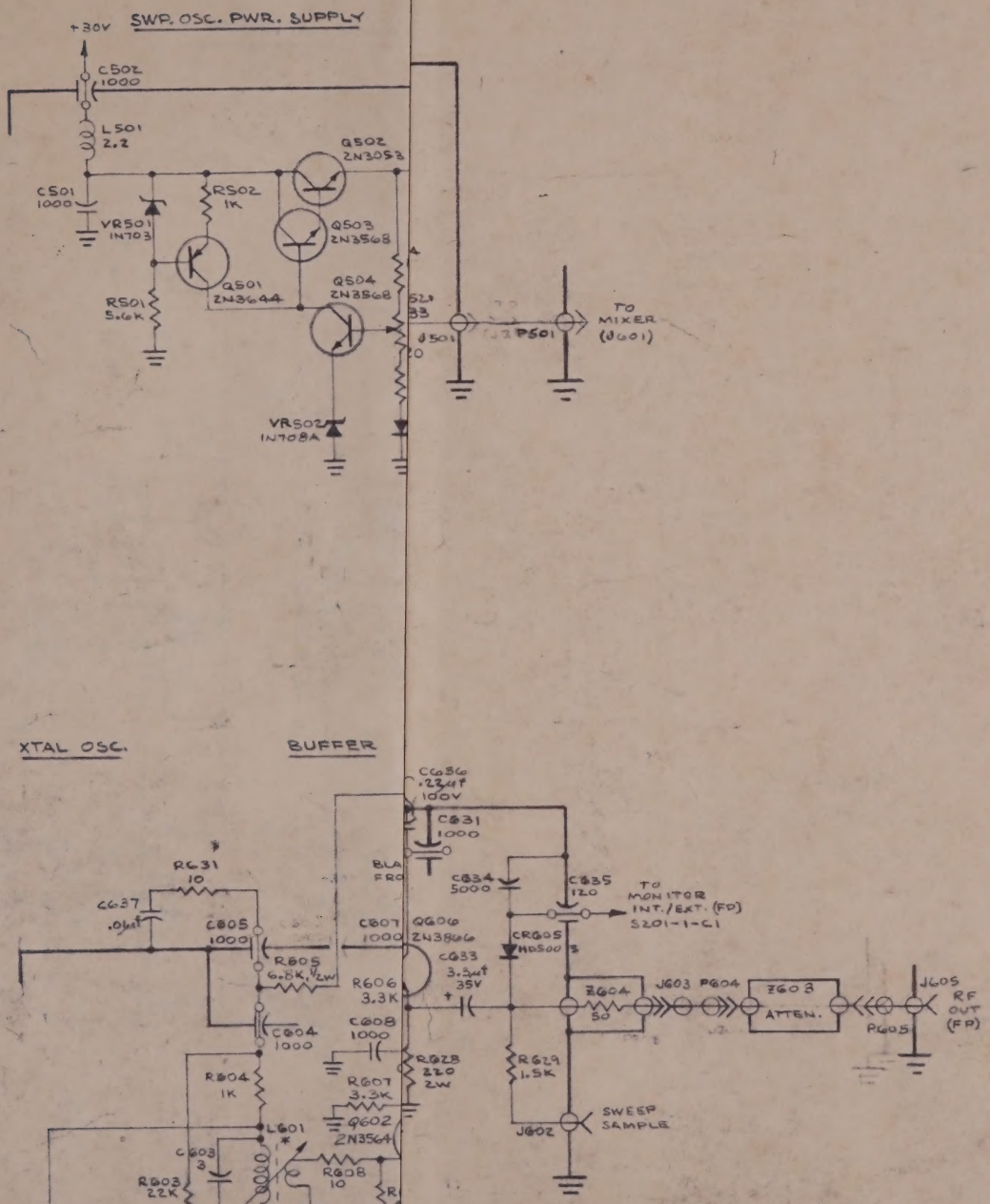

RATE CIRCUIT
LINEARITY
SWEEP RATE (FP)
S103
LINE SYNC INPUT
C101 .01μf
C106 .01μf
LINE 5Hz-60Hz .05Hz-5Hz MANUAL EXT.
R104 1M
R102 100K
UPPER TRIG POINT R101 25K
R103 100K
R116 560K
R111 10K
R105 47K
R112 33K
R115 22K
R113 68K
Q101 2N3565
Q102 2N3565
R114 56K
R110 1K
LINE DC LEVEL R106 1M
VR101 5.6V
CR115 IN457A
-30V.
R107 1.5K
LOWER TRIG POINT R108 2K
R109 1.5K
+30
C103 1.5μf 35V.
C102 .22μf 100V.
R123 2K
R121 6.8K 1/2W 5%
LINE TRIG AMPL.
R119 50K
R118 22K
R117 27K
R120C 5M
R120B 500K
R120A 5K
Q103 2N3565
R122 1.2K
Q104 2N3568
R127 390 1/2W
SWEEP RATE VERNIER (FP)
R125 220K 1/2W
R124 100
Q105 2N3568
+200V
R136 220K 1W
R135 68K, 2W
Q106 2N3440
R128 3.9K 1/2W
R130 15K 1/2W
R134 1.2K 1/2W
R131 2K MED. SW. C.F. ADJ
R129 47K 1/2W
R132 2.7K 1/2W
R133 1K 1/2W
-30V.
R137-R146 560K
CR104-CR113 IN457A
R148 22K
R149 27K
R150 33K
R151 47K
R152 56K
R153 82K
R154 120K
R155 180K
R156 330K
R157 560K
Q107 2N3440
R159 WIDE SW. LIMIT 5K
R161 WIDE SW. C.F. ADJ., 1K
R162 4.7K
SWEEP WIDTH VERN. (FP)
S101-2D
R164B 250K
R170 4.7M
SWP. OSC. P. SUPPLY C803 -20V.
S101-2A
R171 560K
R164A 500K
R172 82K
S101-2B
DRIVE VOLTAGE
J101
SCOPE HORIZ (FP)
J102
EXT. DRIVE (RP)
R168 12K
R169 33K
-30V.
WIDE NARROW CW
S101-1A
SWEEP WIDTH (FP)
S101 -30V.
R165 4.7M
+30V.
Q204 2N3568
RF
VIDEO
R166 1M
S102
J309
Q109 FH52
VR201 28V
BLANKING
CR116 IN3287
BLANKING LEVELER CIRCUIT
+50V.
R201 33
R202 15K
Q201 2N3440
CR202
BLANKED B+
R213 82
CR201 IN457A
IN457A
Q202 2N3440
Q203 2N3440
R203 82K
CR203
IN457A
C201
C202 1000
R204 680
-30V.
C205
R214 680 1/2W
R209 RF LEVEL MIN. (FP) 1K
R208 RF VERN. 10K (FP)
R210 RF LEVEL MAX (FP) 5K
R211 22K
C204 .01μf
C203 .01μf
MONITOR INT/EXT. (FP) S201-1C
TO MONITOR C635
Q206 2N3644
Q207 2N3644
R212 8.2K
R205 22K
+30V.
R207 4.7K
R206 4.7K
-30V.
EXT. MON (FP)
J201

FIGURE 6-2


+30V
SWP. OSC. PWR. SUPPLY
C502 1000
L501 2.2
C501 1000
VR501 1N703
RS02 1K
Q502 2N3053
Q503 2N3568
Q501 2N3644
Q504 2N3568
RS01 5.6K
521 33
J501
20
P501
TO MIXER (J601)
VR502 1N708A
XTAL OSC.
BUFFER
CG36 .22µf 100V
C831 1000
RG31 10
BLA FRO
C834 5000
C835 120
TO MONITOR INT./EXT. (FD) S201-1-C1
CG37 .01µf
C805 1000
C807 1000
QG06 2N3866
CRG05 HDS00
R805 6.8K ½W
R606 3.3K
CG33 3.3µf 35V
ZG04 50
J603 PG04
ZG03 ATTEN.
PG05
J605 RF OUT (FP)
C804 1000
C808 1000
RG28 220 2W
RG29 1.5K
R804 1K
R607 3.3K
Q602 2N3564
J602 SWEEP SAMPLE
L601
C603 3
RG08 10
RG03 22K
Y601 100 MHz
C802 120
Q601 2N3564
R601 100
R602 2.2K
CG01 20

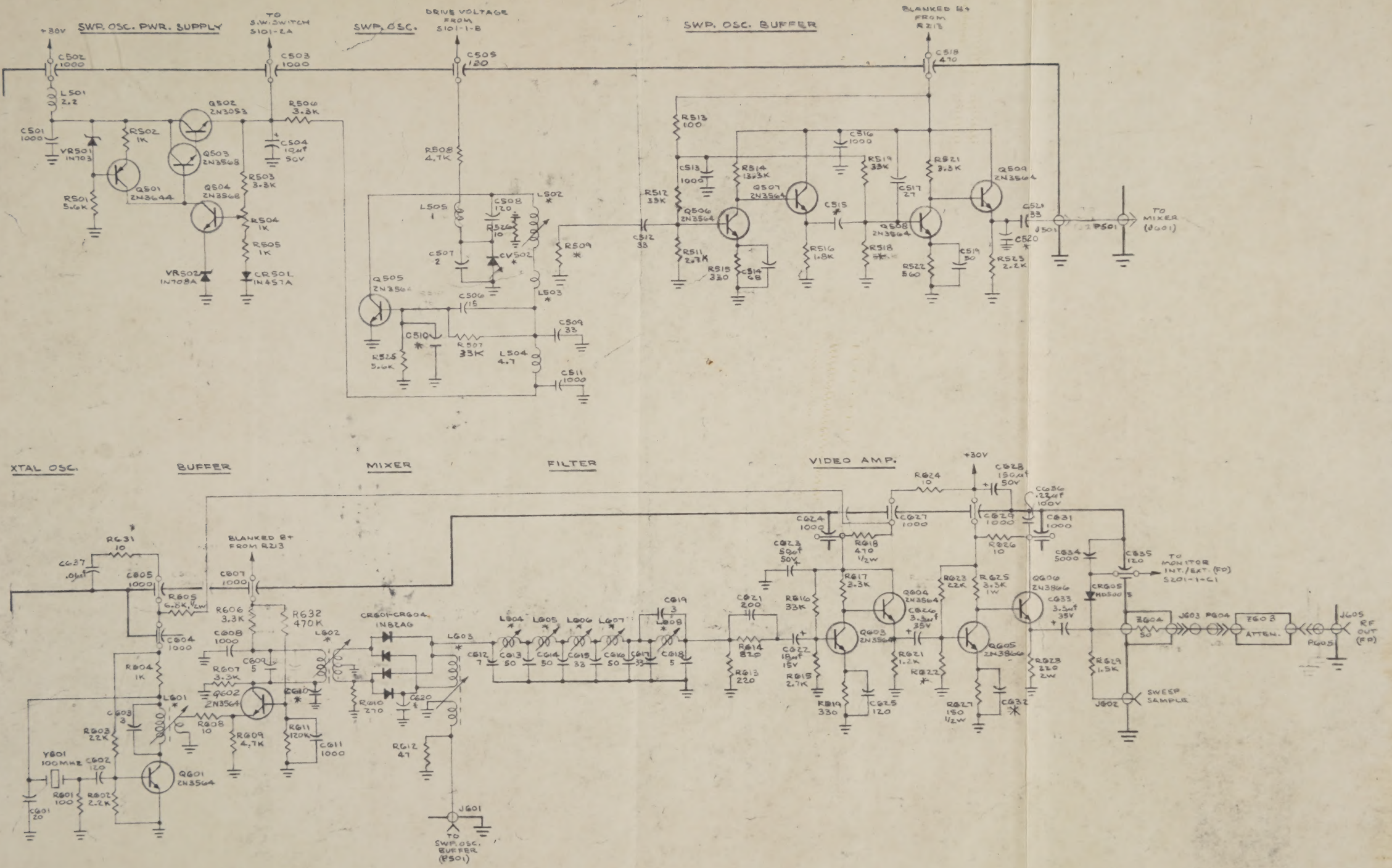
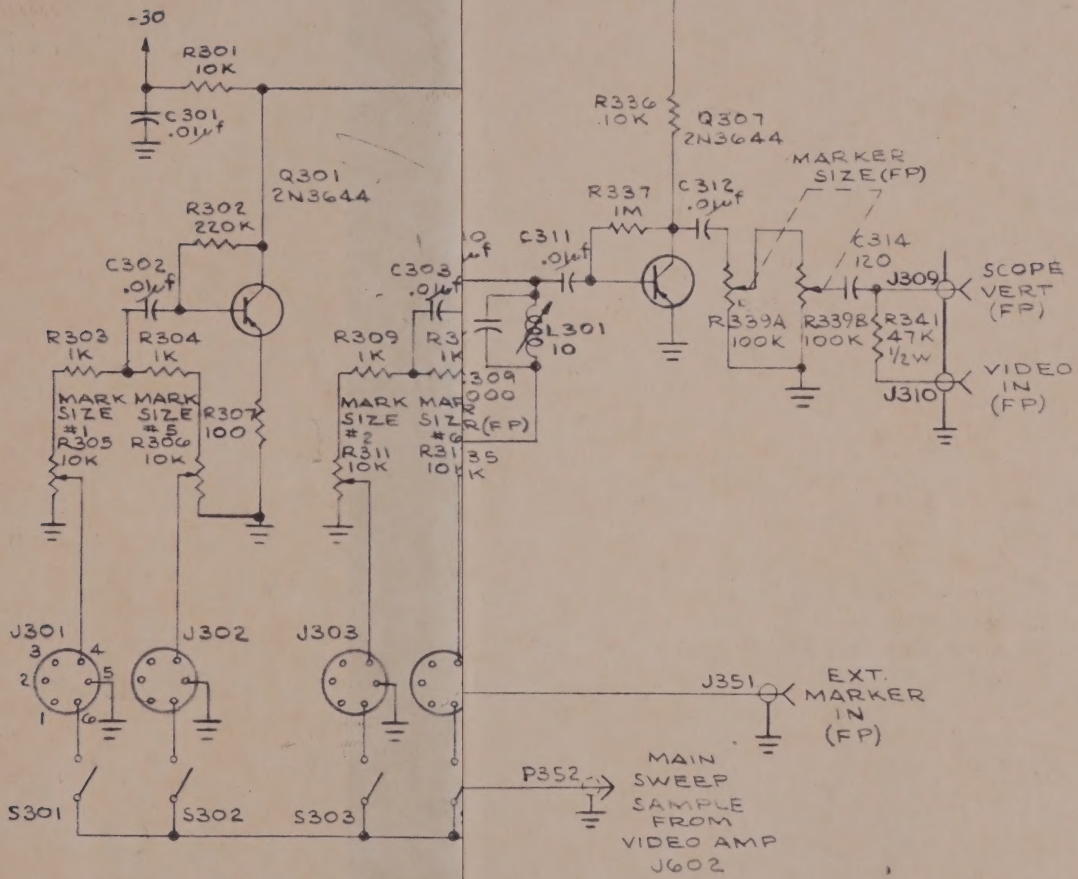

SWP. OSC. PWR. SUPPLY
+30V
TO S.W. SWITCH S101-2A
SWP. OSC.
DRIVE VOLTAGE FROM S101-1-B
SWP. OSC. BUFFER
BLANKED B+ FROM R213
TO MIXER (J601)
XTAL OSC.
BUFFER
MIXER
FILTER
VIDEO AMP.
BLANKED B+ FROM R213
TO MONITOR INT./EXT. (FP) S201-1-C1
SWEEP SAMPLE
RF OUT (FP)
TO SWP. OSC. BUFFER (P501)

FIGURE 6-3

8 PLUG-IN MARK R & SHAPER

E DIVIDER &

MIXER



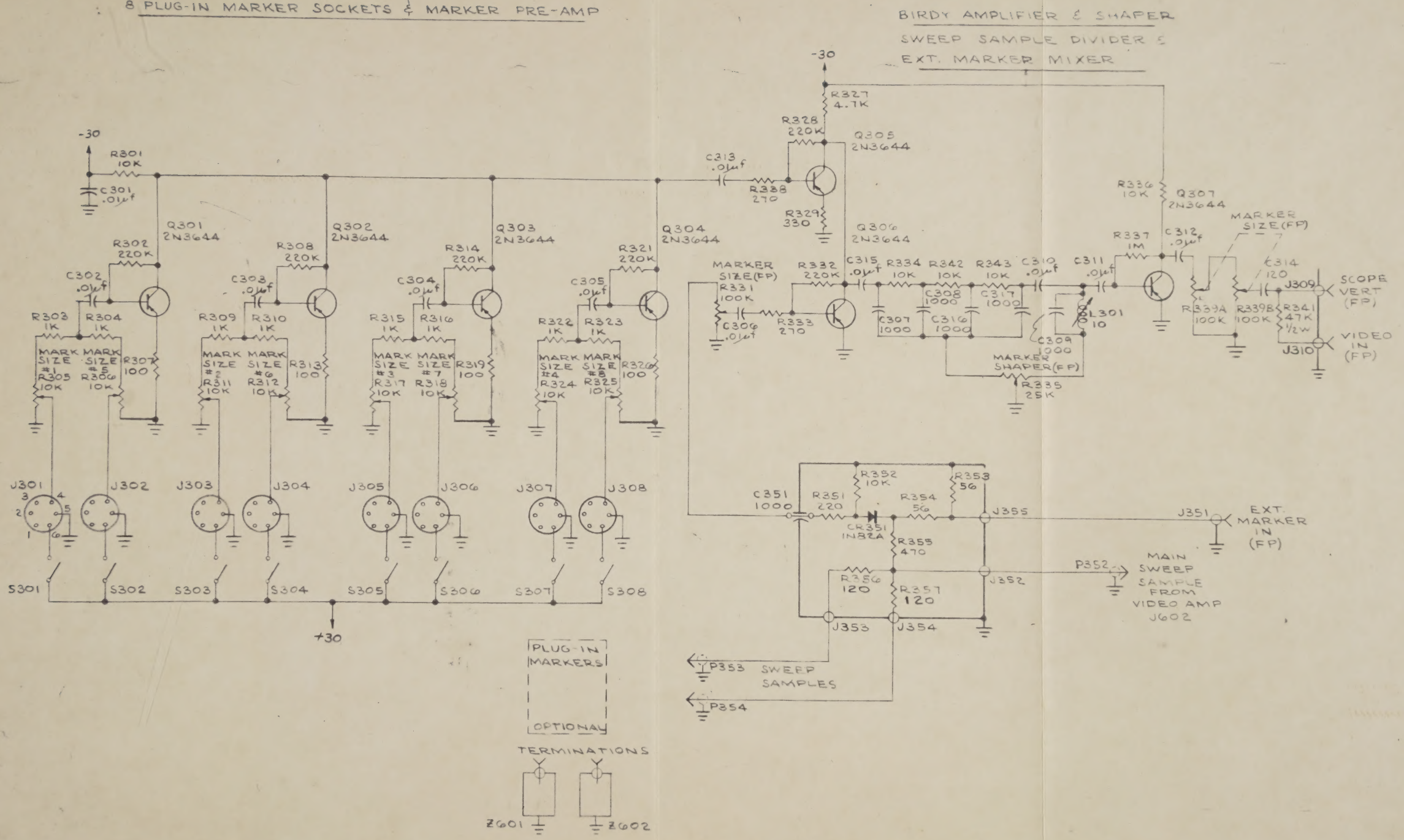
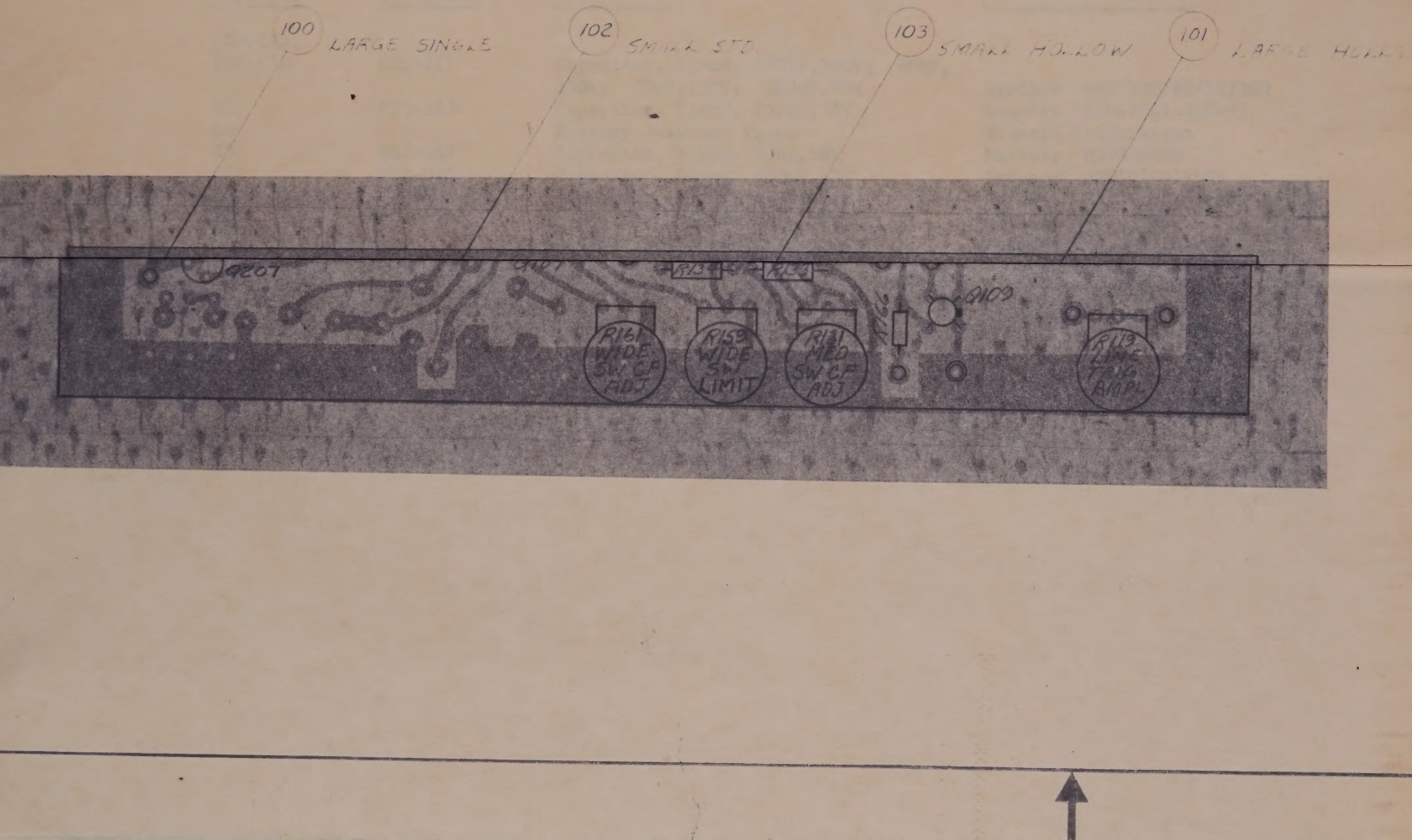
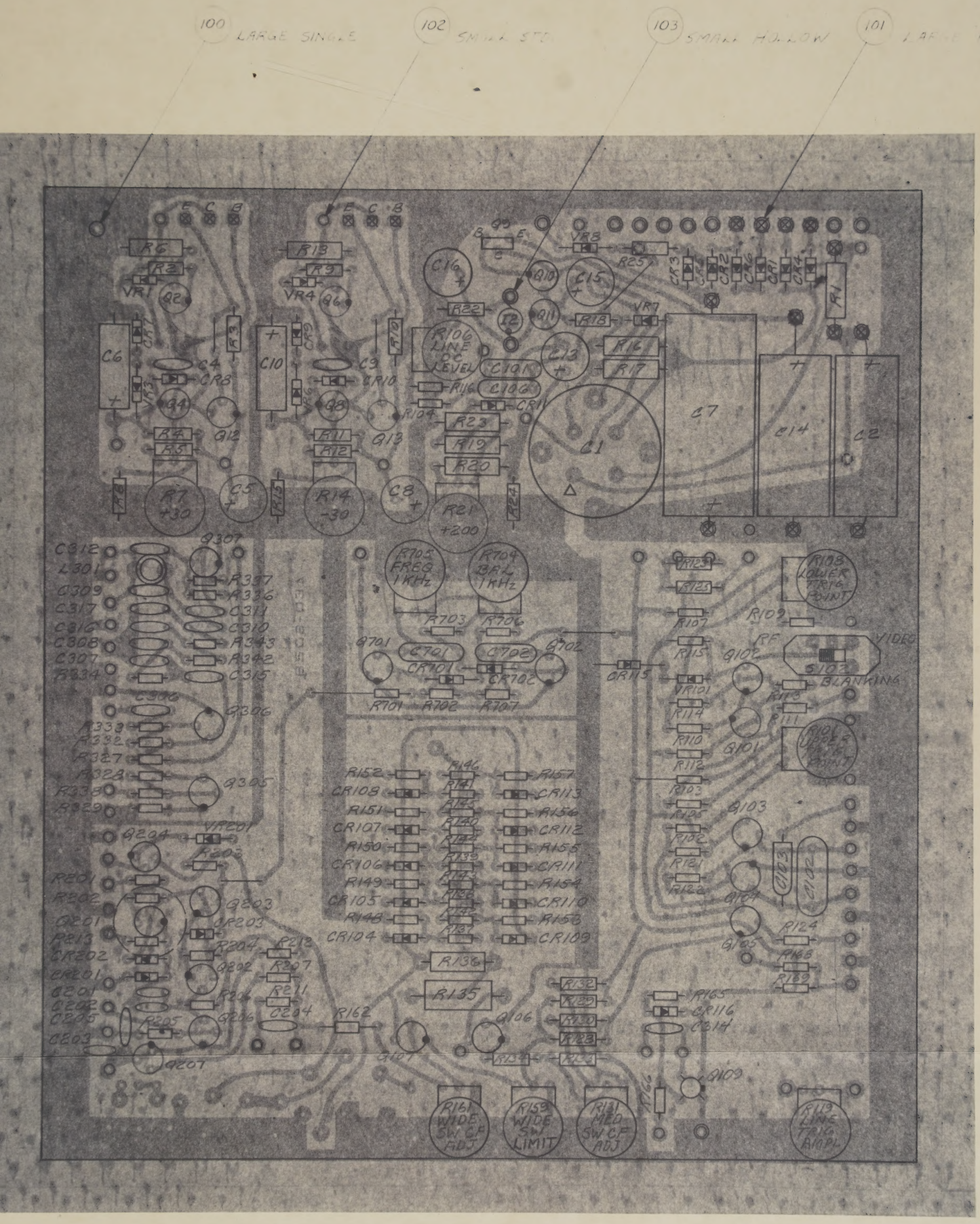

8 PLUG-IN MARKER SOCKETS & MARKER PRE-AMP
BIRDY AMPLIFIER & SHAPER
SWEEP SAMPLE DIVIDER &
EXT. MARKER MIXER
-30
+30
R301 10K
C301 .01µf
Q301 2N3644
Q302 2N3644
Q303 2N3644
Q304 2N3644
R302 220K
R308 220K
R314 220K
R321 220K
C302 .01µf
C303 .01µf
C304 .01µf
C305 .01µf
R303 1K
R304 1K
R309 1K
R310 1K
R315 1K
R316 1K
R322 1K
R323 1K
MARK SIZE #1 R305 10K
MARK SIZE #5 R306 10K
R307 100
MARK SIZE #2 R311 10K
MARK SIZE #6 R312 10K
R313 100
MARK SIZE #3 R317 10K
MARK SIZE #7 R318 10K
R319 100
MARK SIZE #4 R324 10K
MARK SIZE #8 R325 10K
R320 100
J301
J302
J303
J304
J305
J306
J307
J308
S301
S302
S303
S304
S305
S306
S307
S308
PLUG-IN MARKERS
OPTIONAL
TERMINATIONS
Z601
Z602
C313 .01µf
R328 220K
R338 270
R329 330
Q305 2N3644
Q306 2N3644
R327 4.7K
MARKER SIZE(FP)
R331 100K
C306 .01µf
R333 270
R332 220K
C315 .01µf
R334 10K
R342 10K
R343 10K
C310 .01µf
C311 .01µf
C307 1000
C308 1000
C316 1000
C317 1000
C309 1000
MARKER SHAPER(FP)
R335 25K
L301 10
R336 10K
Q307 2N3644
R337 1M
C312 .01µf
MARKER SIZE(FP)
C314 120
R339A 100K
R339B 100K
R341 47K 1/2W
J309
J310
SCOPE VERT (FP)
VIDEO IN (FP)
C351 1000
R351 220
R352 10K
R353 56
R354 56
CR351 1N82A
R355 470
R356 120
R357 120
J355
J351
EXT. MARKER IN (FP)
J352
J353
J354
P352
MAIN SWEEP SAMPLE FROM VIDEO AMP J602
P353
SWEEP SAMPLES
P354

FIGURE 6-4


100
LARGE SINGLE
102
SMALL STD.
103
SMALL HOLLOW
101
Q207
R134
R133
Q109
R166
R161
WIDE
SW CF
ADJ
R159
WIDE
SW
LIMIT
R131
MED
SW CF
ADJ
R119
LINE
TRIG
AMPL


100 LARGE SINGLE
102 SMALL STD
103 SMALL HOLLOW
101 LARGE HOLL
R106 LINE DC LEVEL
R7 +30
R14 -30
R21 +200
R705 FREQ 1KHz
R704 BAL 1KHz
R108 LOWER TRIG POINT
VIDEO
S102 BLANKING
R101 UPPER TRIG POINT
R161 WIDE SW CF ADJ
R159 WIDE SW LIMIT
R131 MED SW CF ADJ
R119 LINE TRIG AMPL

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C1A,C1B, C1C,C1D	012-221	Capacitor, Fixed, 100uF,300V; 80uF, 250V; 30uF,150V; 300uF,90V	Synchro MEP 100/80/30/300
C2	012-223	Capacitor, Fixed, 250uF,75V	Synchro EMW-2052-250-75
C4		Factory Selected Value	Texscan Corporation
C5	012-082	Capacitor, Fixed, 50uF,50V	Mallory MTV50DE50
C6	012-015	Capacitor, Fixed, 100uF,12V	Sprague 30D107G012DC4
C7	012-222	Capacitor, Fixed, 450uF,90V	Synchro EMW-2868-450-90
C8	012-082	Capacitor, Fixed, 50uF,50V	Mallory MTV50DE50
C9		Factory Selected Value	Texscan Corporation
C10	012-015	Capacitor, Fixed, 100uF,12V	Sprague 30D107G012DC4
C13	012-023	Capacitor, Fixed, 0.1uF,200V	Standard Condenser MBA200
C14	012-225	Capacitor, Fixed, 50uF,250V	Synchro EMW-2452-50-250
C15	012-023	Capacitor, Fixed, 0.1uF,200V	Standard Condenser MBA200
C16	012-024	Capacitor, Fixed, 0.22uF,200V	Standard Condenser MBA200
C101	012-066	Capacitor, Fixed, 0.01uF,100V	Sprague 225P10391
C102	012-020	Capacitor, Fixed, 0.22uF,100V	Cornell-Dubilier DMF1P22
C103	012-155	Capacitor, Fixed, 1.5uF,35V	Kemet K-1R5C35K
C106	012-066	Capacitor, Fixed, 0.01uF,100V	Sprague 225P10391
C201		Factory Selected Value	Texscan Corporation
C202	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C203	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C204	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C205		Factory Selected Value	Texscan Corporation
C301	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C302	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C303	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C304	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C305	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C306	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C307	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C308	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C309	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C310	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C311	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C312	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C313	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C314	012-013	Capacitor, Fixed, 120pF,1000V	RMC C120-N1500
C315	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
C316	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C317	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C351	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C501	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C502	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C503	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C504	012-100	Capacitor, Fixed, 10uF,50V	Sprague TE1304
C505	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C506	012-135	Capacitor, Fixed, 15pF,500V	Arco DM-10-150J
C507		Factory Selected Value	Texscan Corporation
C508	012-047	Capacitor, Fixed, 120pF,500V	Arco DM-10-121J
C509		Factory Selected Value	Texscan Corporation
C510		Factory Selected Value	Texscan Corporation
C511	012-138	Capacitor, Fixed, 1000pF,100V	Arco DM-15-102J
C512	012-084	Capacitor, Fixed, 33pF,1000V	RMC Type C (33NPO)
C513	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C514	012-031	Capacitor, Fixed, 68pF,1000V	Centralab DD680
C515		Factory Selected Value	Texscan Corporation
C516	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C517	012-030	Capacitor, Fixed, 27pF,500V	Centralab 1D270
C518	012-036	Capacitor, Fixed, 470pF, Feedthru	Allen Bradley FA5C
C519	012-012	Capacitor, Fixed, 50pF,1000V	RMC Type C (N750)
C520		Factory Selected Value	Texscan Corporation
C521	012-084	Capacitor, Fixed, 33pF,1000V	RMC Type C (NPO)

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C601	012-007	Capacitor, Fixed, 20pF,1000V	RMC Type C (NPO)
C602	012-013	Capacitor, Fixed, 120pF,1000V	RMC Type C (N1500)
C603	012-010	Capacitor, Fixed, 3pF,1000V	RMC Type C (NPO)
C604	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C605	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C607	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C608	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C609	012-092	Capacitor, Fixed, 5pF,1000V	RMC Type C (NPO)
C610		Factory Selected Value	Texscan Corporation
C611	012-009	Capacitor, Fixed, 1000pF,500V	RMC SM.001
C612	012-057	Capacitor, Fixed, 7pF,1000V	RMC Type C (NPO)
C613	012-012	Capacitor, Fixed, 50pF,1000V	RMC Type C (N750)
C614	012-012	Capacitor, Fixed, 50pF,1000V	RMC Type C (N750)
C615	012-084	Capacitor, Fixed, 33pF,1000V	RMC Type C (NPO)
C616	012-012	Capacitor, Fixed, 50pF,1000V	RMC Type C (N750)
C617	012-084	Capacitor, Fixed, 33pF,1000V	RMC Type C (NPO)
C618	012-092	Capacitor, Fixed, 5pF,1000V	RMC Type C (NPO)
C619	012-010	Capacitor, Fixed, 3pF,1000V	RMC Type C (NPO)
C620		Factory Selected Value	Texscan Corporation
C621	012-052	Capacitor, Fixed, 200pF,1000V	RMC Type C (N1500)
C622	012-133	Capacitor, Fixed, 18uF,15V	Kemet K18C15K
C623	012-027	Capacitor, Fixed, 50uF,50V	Cornell-Dubilier BR50-50
C624	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C625	012-013	Capacitor, Fixed, 120pF,1000V	RMC Type C (N1500)
C626	012-131	Capacitor, Fixed, 3.3uF,35V	Kemet K3R3C35K
C627	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C628	012-102	Capacitor, Fixed, 150uF,50V	Cornell-Dubilier BR150-50
C629	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C631	012-001	Capacitor, Fixed, 1000pF, Feedthru	Allen Bradley FA5C-GMV
C632		Factory Selected Value	Texscan Corporation
C633	012-131	Capacitor, Fixed, 3.3uF,35V	Kemet K3R3C35K
C634	012-085	Capacitor, Fixed, 0.005uF,500V	RMC SM.005

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
C635	012-058	Capacitor, Fixed, 120pF, Feedthru	Allen Bradley FA5C
C636	012-020	Capacitor, Fixed, 0.22uF,100V	Cornell-Dubilier DMF1P22
C637	012-050	Capacitor, Fixed, 0.01uF,100V	RMC TA.01
CR1	025-044	Diode, E-8	Sarkes-Tarzian E-8
CR2	025-007	Diode, E-4	General Electric A13D2
CR3	025-007	Diode, E-4	General Electric A13D2
CR4	025-044	Diode, E-8	Sarkes-Tarzian E-8
CR5	025-007	Diode, E-4	General Electric A13D2
CR6	025-007	Diode, E-4	General Electric A13D2
CR7	025-034	Diode, 1N457A	Sylvania 1N457A
CR8	025-034	Diode, 1N457A	Sylvania 1N457A
CR9	025-034	Diode, 1N457A	Sylvania 1N457A
CR10	025-034	Diode, 1N457A	Sylvania 1N457A
CR11	025-034	Diode, 1N457A	Sylvania 1N457A
CR104	025-034	Diode, 1N457A	Sylvania 1N457A
CR105	025-034	Diode, 1N457A	Sylvania 1N457A
CR106	025-034	Diode, 1N457A	Sylvania 1N457A
CR107	025-034	Diode, 1N457A	Sylvania 1N457A
CR108	025-034	Diode, 1N457A	Sylvania 1N457A
CR109	025-034	Diode, 1N457A	Sylvania 1N457A
CR110	025-034	Diode, 1N457A	Sylvania 1N457A
CR111	025-034	Diode, 1N457A	Sylvania 1N457A
CR112	025-034	Diode, 1N457A	Sylvania 1N457A
CR113	025-034	Diode, 1N457A	Sylvania 1N457A
CR115	025-034	Diode, 1N457A	Sylvania 1N457A
CR116	025-061	Diode, 1N3287	ITT 1N3287
CR201	025-034	Diode, 1N457A	Sylvania 1N457A
CR202	025-034	Diode, 1N457A	Sylvania 1N457A
CR203	025-034	Diode, 1N457A	Sylvania 1N457A
CR351	025-002	Diode, 1N82A	Sylvania 1N82A
CR501	025-034	Diode, 1N457A	Sylvania 1N457A

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
CR601	025-002	Diode, 1N82AG	Sylvania 1N82AG
CR602	025-002	Diode, 1N82AG	Sylvania 1N82AG
CR603	025-002	Diode, 1N82AG	Sylvania 1N82AG
CR604	025-002	Diode, 1N82AG	Sylvania 1N82AG
CR605	025-016	Diode, HD5003	Hughes HD5003
CV502		Factory Selected Value	Texscan Corporation
F1	034-001	Fuse, 1 Amp, 250V	Littelfuse 312001 (3AG)
I1	011-001	Bulb, Indicator Light	Drake 6063-634
I2	011-003	Bulb, 82V	Signalite Z82R10
J101	020-016	Connector, RF, 5069	Startronics 5069
J102	020-011	Connector, RF, UG625B/U	Startronics UG625B/U
J201	020-016	Connector, RF, 5069	Startronics 5069
J301	054-003	Socket, Six Pin	Cinch 201-41-06-243
J302	054-003	Socket, Six Pin	Cinch 201-41-06-243
J303	054-003	Socket, Six Pin	Cinch 201-41-06-243
J304	054-003	Socket, Six Pin	Cinch 201-41-06-243
J305	054-003	Socket, Six Pin	Cinch 201-41-06-243
J306	054-003	Socket, Six Pin	Cinch 201-41-06-243
J307	054-003	Socket, Six Pin	Cinch 201-41-06-243
J308	054-003	Socket, Six Pin	Cinch 201-41-06-243
J309	020-016	Connector, RF, 5069	Startronics 5069
J310	020-016	Connector, RF, 5069	Startronics 5069
J351	020-017	Connector, RF, 5070	Startronics 5070
J352	020-018	Connector, RF, MX1684/U	Startronics MX1684/U
J353	020-018	Connector, RF, MX1684/U	Startronics MX1684/U
J354	020-018	Connector, RF, MX1684/U	Startronics MX1684/U
J355	020-018	Connector, RF, MX1684/U	Startronics MX1684/U
J501	020-018	Connector, RF, MX1684/U	Startronics MX1684/U

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
J601	020-011	Connector, RF, UG625B/U	Startronics UG625B/U
J602	020-011	Connector, RF, UG625B/U	Startronics UG625B/U
J603	020-050	Connector, RF, UG89C/U	Startronics UG89C/U
J605	020-017	Connector, RF, 5070	Startronics 5070
L301	035-008	Inductor, Variable, 10mH	Central Coil H0813-15
L501	035-002	Inductor, Fixed, 2.2uH	Jeffers 4436-4K
L502		Factory Selected Value	Texscan Corporation
L503		Factory Selected Value	Texscan Corporation
L504	035-019	Inductor, Fixed, 4.7uH	Jeffers 4436-8K
L505	035-001	Inductor, Fixed, 1.0uH	Jeffers 4426-6K
L601		Factory Selected Value	Texscan Corporation
L602		Factory Selected Value	Texscan Corporation
L603		Factory Selected Value	Texscan Corporation
L604		Factory Selected Value	Texscan Corporation
L605		Factory Selected Value	Texscan Corporation
L606		Factory Selected Value	Texscan Corporation
L607		Factory Selected Value	Texscan Corporation
L608		Factory Selected Value	Texscan Corporation
P1	019-004	Conductor, Line Cord	Cord Specialty SV-18/3
P352	020-021	Connector, RF, UG88C/U	Startronics UG88C/U
P353	020-021	Connector, RF, UG88C/U	Startronics UG88C/U
P354	020-021	Connector, RF, UG88C/U	Startronics UG88C/U
P501	020-021	Connector, RF, UG88C/U	Startronics UG88C/U
P604	020-021	Connector, RF, UG88C/U	Startronics UG88C/U
P605	020-021	Connector, RF, UG88C/U	Startronics UG88C/U
Q1	062-099	Transistor, MJE1103	Motorola MJE1103
Q2	062-100	Transistor, 2N4314	RCA 2N4314
Q4	062-008	Transistor, 2N3440	RCA 2N3440

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
Q5	062-098	Transistor, MJE1093	Motorola MJE1093
Q6	062-008	Transistor, 2N3440	RCA 2N3440
Q8	062-100	Transistor, 2N4314	RCA 2N4314
Q9	062-055	Transistor, MJE340	Motorola MJE340
Q10	062-008	Transistor, 2N3440	RCA 2N3440
Q11	062-008	Transistor, 2N3440	RCA 2N3440
Q12	062-008	Transistor, 2N3440	RCA 2N3440
Q13	062-100	Transistor, 2N4314	RCA, 2N4314
Q101	062-002	Transistor, 2N3565	Fairchild 2N3565
Q102	062-002	Transistor, 2N3565	Fairchild 2N3565
Q103	062-002	Transistor, 2N3565	Fairchild 2N3565
Q104	062-015	Transistor, 2N3568	Fairchild 2N3568
Q105	062-015	Transistor, 2N3568	Fairchild 2N3568
Q106	062-008	Transistor, 2N3440	RCA 2N3440
Q107	062-008	Transistor, 2N3440	RCA 2N3440
Q109	062-012	Transistor, 2N4221	Motorola 2N4221
Q201	062-008	Transistor, 2N3440	RCA 2N3440
Q202	062-008	Transistor, 2N3440	RCA 2N3440
Q203	062-008	Transistor, 2N3440	RCA 2N3440
Q204	062-015	Transistor, 2N3568	Fairchild 2N3568
Q206	062-024	Transistor, 2N3644	Fairchild 2N3644
Q207	062-024	Transistor, 2N3644	Fairchild 2N3644
Q301	062-024	Transistor, 2N3644	Fairchild 2N3644
Q302	062-024	Transistor, 2N3644	Fairchild 2N3644
Q303	062-024	Transistor, 2N3644	Fairchild 2N3644
Q304	062-024	Transistor, 2N3644	Fairchild 2N3644
Q305	062-024	Transistor, 2N3644	Fairchild 2N3644
Q306	062-024	Transistor, 2N3644	Fairchild 2N3644
Q307	062-024	Transistor, 2N3644	Fairchild 2N3644
Q501	062-024	Transistor, 2N3644	Fairchild 2N3644
Q502	062-005	Transistor, 2N3053	RCA 2N3053
Q503	062-015	Transistor, 2N3568	Fairchild 2N3568
Q504	062-015	Transistor, 2N3568	Fairchild 2N3568

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
Q505	062-001	Transistor, 2N3564	Fairchild 2N3564
Q506	062-001	Transistor, 2N3564	Fairchild 2N3564
Q507	062-001	Transistor, 2N3564	Fairchild 2N3564
Q508	062-001	Transistor, 2N3564	Fairchild 2N3564
Q509	062-001	Transistor, 2N3564	Fairchild 2N3564
Q601	062-001	Transistor, 2N3564	Fairchild 2N3564
Q602	062-001	Transistor, 2N3564	Fairchild 2N3564
Q603	062-001	Transistor, 2N3564	Fairchild 2N3564
Q604	062-001	Transistor, 2N3564	Fairchild 2N3564
Q605	062-016	Transistor, 2N3866	Vector 2N3866
Q606	062-016	Transistor, 2N3866	Vector 2N3866
R1	046-372	Resistor, Fixed, 120 ohm, 1W, 10%	Allen Bradley
R2	046-124	Resistor, Fixed, 2.2kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R3	047-479	Resistor, Fixed, 1ohm, $\frac{1}{2}$W, 10%	Allen Bradley
R4	046-131	Resistor, Fixed, 3.3ohm, $\frac{1}{2}$W, 10%	Allen Bradley
R5	046-142	Resistor, Fixed, 5.6ohm, $\frac{1}{2}$W, 10%	Allen Bradley
R6	046-442	Resistor, Fixed, 5.6ohm, 1W, 10%	Allen Bradley
R7	048-030	Resistor, Variable, 1kohm	CTS UPE200RE
R8	046-124	Resistor, Fixed, 2.2kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R9	046-124	Resistor, Fixed, 2.2Kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R10	047-480	Resistor, Fixed, 2.2 ohm, $\frac{1}{2}$W, 10%	Allen Bradley
R11	046-131	Resistor, Fixed, 3.3kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R12	046-142	Resistor, Fixed, 5.6Kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R13	046-442	Resistor, Fixed, 5.6Kohm, 1W, 10%	Allen Bradley
R14	048-030	Resistor, Variable, 1Kohm	CTS UPE200RE
R15	046-124	Resistor, Fixed, 2.2Kohm, $\frac{1}{2}$W, 10%	Allen Bradl y
R16	046-463	Resistor, Fixed, 18Kohm, 1W, 10%	Allen Bradley
R17	046-428	Resistor, Fixed, 2.7Kohm, 1W, 10%	Allen Bradley
R18	046-166	Resistor, Fixed, 22kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R19	046-480	Resistor, Fixed, 47Kohm, 1W, 10%	Allen Bradley
R20	046-483	Resistor, Fixed, 56Kohm, 1W, 5%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R21	048-026	Resistor, Variable, 25Kohm	CTS UPE200RE
R22	048-068	Resistor, Fixed, 100 ohm, $\frac{1}{2}$W, 10%	Allen Bradley
R23	046-476	Resistor, Fixed, 39Kohm, 1W, 5%	Allen Bradley
R24	046-205	Resistor, Fixed, 180Kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R25	046-166	Resistor, Fixed, 22Kohm, $\frac{1}{2}$W, 10%	Allen Bradley
R101	048-026	Resistor, Variable, 25Kohm	CTS UPE200RE
R102	045-794	Resistor, Fixed, 100Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R103	045-794	Resistor, Fixed, 100Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R104	045-836	Resistor, Fixed, 1Mohm, $\frac{1}{4}$W, 10%	Allen Bradley
R105	045-780	Resistor, Fixed, 47Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R106	048-032	Resistor, Variable, 1Mohm	CTS UPE200RE
R107	045-717	Resistor, Fixed, 1.5Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R108	048-023	Resistor, Variable, 2Kohm	CTS UPE200RE
R109	045-717	Resistor, Fixed, 1.5Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R110	045-710	Resistor, Fixed, 1Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R111	045-752	Resistor, Fixed, 10Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R112	045-773	Resistor, Fixed, 33Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R113	045-787	Resistor, Fixed, 68Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R114	045-784	Resistor, Fixed, 56Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R115	045-766	Resistor, Fixed, 22Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R116	045-826	Resistor, Fixed, 560Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R117	045-770	Resistor, Fixed, 27Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R118	045-766	Resistor, Fixed, 22Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R119	048-054	Resistor, Variable, 50Kohm	CTS UPE200RE
R120A, R120B R120C, S103	048-094	Resistor, Variable, Switch Assembly, 500K/5K/5Mohm	CTS C212-25211-3-3
R121	045-745	Resistor, Fixed, 6.8Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R122	045-714	Resistor, Fixed, 1.2Kohm, $\frac{1}{4}$W, 10%	Allen Bradley
R123	046-122	Resistor, Fixed, 2Kohm, $\frac{1}{2}$W, 5%	Allen Bradley
R124	045-668	Resistor, Fixed, 100 ohm, $\frac{1}{4}$W, 10%	Allen Bradley
R125	046-208	Resistor, Fixed, 220Kohm, $\frac{1}{2}$W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R127	046-093	Resistor, Fixed, 390 ohm, ½W, 10%	Allen Bradley
R128	046-135	Resistor, Fixed, 3.9Kohm, ½W, 10%	Allen Bradley
R129	046-138	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R130	046-159	Resistor, Fixed, 15Kohm, ½W, 10%	Allen Bradley
R131	048-023	Resistor, Variable, 2Kohm	CTS UPE200RE
R132	046-128	Resistor, Fixed, 2.7Kohm, ½W, 10%	Allen Bradley
R133	046-110	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R134	046-114	Resistor, Fixed, 1.2Kohm, ½W, 10%	Allen Bradley
R135	046-787	Resistor, Fixed, 68Kohm, 2W, 10%	Allen Bradley
R136	046-508	Resistor, Fixed, 220Kohm, 1W, 5%	Allen Bradley
R137	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R138	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R139	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R140	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R141	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R142	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R143	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R144	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R145	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R146	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R148	045-766	Resistor, Fixed, 22Kohm, ¼W, 10%	Allen Bradley
R149	045-770	Resistor, Fixed, 27Kohm, ¼W, 10%	Allen Bradley
R150	045-773	Resistor, Fixed, 33Kohm, ¼W, 10%	Allen Bradley
R151	045-780	Resistor, Fixed, 47Kohm, ¼W, 10%	Allen Bradley
R152	045-784	Resistor, Fixed, 56Kohm, ¼W, 10%	Allen Bradley
R153	045-791	Resistor, Fixed, 82Kohm, ¼W, 10%	Allen Bradley
R154	045-798	Resistor, Fixed, 120Kohm, ¼W, 10%	Allen Bradley
R155	045-805	Resistor, Fixed, 180Kohm, ¼W, 10%	Allen Bradley
R156	045-815	Resistor, Fixed, 330Kohm, ¼W, 10%	Allen Bradley
R157	045-826	Resistor, Fixed, 560Kohm, ¼W, 10%	Allen Bradley
R159	048-024	Resistor, Variable, 5Kohm	CTS UPE200RE
R161	048-030	Resistor, Variable, 1Kohm	CTS UPE200RE

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R162	045-738	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R164A, R164B, S101	048-078	Resistor, Variable, 500K/250K/Switch	CTS C212-A19436-2-2-VC
R165	045-864	Resistor, Fixed, 4.7Mohm, ½W, 10%	Allen Bradley
R166	045-836	Resistor, Fixed, 1.0Mohm, ½W, 10%	Allen Bradley
R168	045-756	Resistor, Fixed, 12Kohm, ½W, 10%	Allen Bradley
R169	045-773	Resistor, Fixed, 33Kohm, ½W, 10%	Allen Bradley
R170	045-864	Resistor, Fixed, 4.7Mohm, ½W, 10%	Allen Bradley
R171	045-826	Resistor, Fixed, 560Kohm, ½W, 10%	Allen Bradley
R172	045-791	Resistor, Fixed, 82Kohm, ½W, 10%	Allen Bradley
R201	045-647	Resistor, Fixed, 33 ohm, ½W, 10%	Allen Bradley
R202	045-759	Resistor, Fixed, 15Kohm, ½W, 10%	Allen Bradley
R203	045-791	Resistor, Fixed, 82Kohm, ½W, 10%	Allen Bradley
R204	045-703	Resistor, Fixed, 680 ohm, ½W, 10%	Allen Bradley
R205	045-766	Resistor, Fixed, 22Kohm, ½W, 10%	Allen Bradley
R206	045-738	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R207	045-738	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R208, S201, S701	048-059	Resistor, Variable, 10K/4P2T Switch	CTS 212-25182-1-VC
R209	048-035	Resistor, Variable, 1Kohm	CTS 200
R210	048-036	Resistor, Variable, 5Kohm	CTS 200
R211	045-766	Resistor, Fixed, 22Kohm, ½W, 10%	Allen Bradley
R212	045-749	Resistor, Fixed, 8.2Kohm, ½W, 10%	Allen Bradley
R213	045-665	Resistor, Fixed, 82 ohm, ½W, 10%	Allen Bradley
R214	046-103	Resistor, Fixed, 680 ohm, ½W, 10%	Allen Bradley
R301	045-752	Resistor, Fixed, 10Kohm, ½W, 10%	Allen Bradley
R302	045-808	Resistor, Fixed, 220Kohm, ½W, 10%	Allen Bradley
R303	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R304	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R305	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R306	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R307	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R308	045-808	Resistor, Fixed, 220Kohm, ½W, 10%	Allen Bradley
R309	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R310	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R311	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R312	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R313	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R314	045-808	Resistor, Fixed, 220Kohm, ½W, 10%	Allen Bradley
R315	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R316	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R317	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R318	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R319	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R321	045-808	Resistor, Fixed, 220Kohm, ½W, 10%	Allen Bradley
R322	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R323	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R324	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R325	048-014	Resistor, Variable, 10Kohm	CTS UHT201
R326	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R327	045-738	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R328	045-808	Resistor, Fixed, 220Kohm, ½W, 10%	Allen Bradley
R329	045-689	Resistor, Fixed, 330 ohm, ½W, 10%	Allen Bradley
R331, S309	048-079	Resistor, Variable, Switch Assembly, 100Kohm/SPST	CTS TH5990
R332	045-808	Resistor, Fixed, 220Kohm, ½W, 10%	Allen Bradley
R333	045-686	Resistor, Fixed, 270 ohm, ½W, 10%	Allen Bradley
R334	045-752	Resistor, Fixed, 10Kohm, ½W, 10%	Allen Bradley
R335		See R339	
R336	045-752	Resistor, Fixed, 10Kohm, ½W, 10%	Allen Bradley
R337	045-836	Resistor, Fixed, 1Mohm, ½W, 10%	Allen Bradley
R338	045-686	Resistor, Fixed, 270 ohm, ½W, 10%	Allen Bradley
R339A, R339B, R335	048-060	Resistor, Variable, 100K/100K/25Kohm	CTS C45-2-45

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R341	046-180	Resistor, Fixed, 47Kohm, ½W, 10%	Allen Bradley
R342	045-752	Resistor, Fixed, 10Kohm, ½W, 10%	Allen Bradley
R343	045-752	Resistor, Fixed, 10Kohm, ½W, 10%	Allen Bradley
R351	045-682	Resistor, Fixed, 220 ohm, ½W, 10%	Allen Bradley
R352	045-752	Resistor, Fixed, 10Kohm, ½W, 10%	Allen Bradley
R353	045-658	Resistor, Fixed, 56 ohm, ½W, 10%	Allen Bradley
R354	045-658	Resistor, Fixed, 56 ohm, ½W, 10%	Allen Bradley
R355	045-696	Resistor, Fixed, 470 ohm, ½W, 10%	Allen Bradley
R356	045-672	Resistor, Fixed, 120 ohm, ½W, 10%	Allen Bradley
R357	045-672	Resistor, Fixed, 120 ohm, ½W, 10%	Allen Bradley
R501	045-742	Resistor, Fixed, 5.6Kohm, ½W, 10%	Allen Bradley
R502	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R503	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R504	048-030	Resistor, Variable, 1Kohm	CTS UPE200RE
R505	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R506	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R507		Factory Selected Value	Texscan Corporation
R508	045-738	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R509		Factory Selected Value	Texscan Corporation
R511	045-728	Resistor, Fixed, 2.7Kohm, ½W, 10%	Allen Bradley
R512	045-773	Resistor, Fixed, 33Kohm, ½W, 10%	Allen Bradley
R513	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R514	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R515	045-689	Resistor, Fixed, 330 ohm, ½W, 10%	Allen Bradley
R516	045-721	Resistor, Fixed, 1.8Kohm, ½W, 10%	Allen Bradley
R518		Factory Selected Value	Texscan Corporation
R519	045-773	Resistor, Fixed, 33Kohm, ½W, 10%	Allen Bradley
R521	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R522	045-700	Resistor, Fixed, 560 ohm, ½W, 10%	Allen Bradley
R523	045-724	Resistor, Fixed, 2.2Kohm, ½W, 10%	Allen Bradley
R525	045-742	Resistor, Fixed, 5.6Kohm, ½W, 10%	Allen Bradley
R526	046-026	Resistor, Fixed, 10 ohm, ½W, 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R601	045-668	Resistor, Fixed, 100 ohm, ½W, 10%	Allen Bradley
R602	045-724	Resistor, Fixed, 2.2Kohm, ½W, 10%	Allen Bradley
R603	045-766	Resistor, Fixed, 22Kohm, ½W, 10%	Allen Bradley
R604	045-710	Resistor, Fixed, 1Kohm, ½W, 10%	Allen Bradley
R605	046-145	Resistor, Fixed, 6.8Kohm, ½W, 10%	Allen Bradley
R606	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R607	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R608	045-626	Resistor, Fixed, 10 ohm, ½W, 10%	Allen Bradley
R609	045-738	Resistor, Fixed, 4.7Kohm, ½W, 10%	Allen Bradley
R610	045-686	Resistor, Fixed, 270 ohm, ½W, 10%	Allen Bradley
R611	045-798	Resistor, Fixed, 120Kohm, ½W, 10%	Allen Bradley
R612	045-654	Resistor, Fixed, 47 ohm, ½W, 10%	Allen Bradley
R613	045-682	Resistor, Fixed, 220 ohm, ½W, 10%	Allen Bradley
R614	045-707	Resistor, Fixed, 820 ohm, ½W, 10%	Allen Bradley
R615	045-728	Resistor, Fixed, 2.7Kohm, ½W, 10%	Allen Bradley
R616	045-773	Resistor, Fixed, 33Kohm, ½W, 10%	Allen Bradley
R617	045-731	Resistor, Fixed, 3.3Kohm, ½W, 10%	Allen Bradley
R618	046-096	Resistor, Fixed, 470 ohm, ½W, 10%	Allen Bradley
R619	045-689	Resistor, Fixed, 330 ohm, ½W, 10%	Allen Bradley
R621	045-714	Resistor, Fixed, 1.2Kohm, ½W, 10%	Allen Bradley
R622		Factory Selected Value	Texscan Corporation
R623	045-766	Resistor, Fixed, 22Kohm, ½W, 10%	Allen Bradley
R624	045-626	Resistor, Fixed, 10 ohm, ½W, 10%	Allen Bradley
R625	046-431	Resistor, Fixed, 3.3Kohm, 1W, 10%	Allen Bradley
R626	045-626	Resistor, Fixed, 10 ohm, ½W, 10%	Allen Bradley
R627	046-075	Resistor, Fixed, 150 ohm, ½W, 10%	Allen Bradley
R628	046-682	Resistor, Fixed, 220 ohm, 2W, 10%	Allen Bradley
R629	045-717	Resistor, Fixed, 1.5Kohm, ½W, 10%	Allen Bradley
R631	045-626	Resistor, Fixed, 10 ohm, ½W, 10%	Allen Bradley
S1	057-004	Switch, SPST, Toggle	Crest Associates CL-100
S101		See R164A and R164B	

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCIRPTION	MFG., MFG. PART NO.
S102	057-003	Switch, Slide	Continental-Wirt G-126
S103		See R120A,R120B, and R120C	
S201		See R208	
R301	057-016	Switch, Rocker	Stackpole RS-72-FB
R302	057-016	Switch, Rocker	Stackpole RS-72-FB
S303	057-016	Switch, Rocker	Stockpole RS-72-FB
S304	057-016	Switch, Rocker	Stackpole RS-72-FB
S305	057-016	Switch, Rocker	Stackpole RS-72-FB
S306	057-016	Switch, Rocker	Stackpole RS-72-FB
S307	057-016	Switch, Rocker	Stackpole RS-72-FB
S308	057-016	Switch, Rocker	Stackpole RS-72-FB
S309		See R331	
S701		See R208	
T1	B061-009	Transformer, Power	American Magnetics 3531
VR1	025-018	Diode, 5.6V Zener, ±5%, 1N708A	International Rectifier 1N708A
VR3	025-033	Diode, 7V Zener, ±5%	Sarkes-Tarzian VR7A
VR4	025-018	Diode, 5.6V Zener, ±5%, 1N708A	International Rectifier 1N708A
VR6	025-033	Diode, 7V Zener, ±5%	Sarkes-Tarzian VR7A
VR7	025-025	Diode, 18V Zener, ±5%	Sarkes-Tarzian VR18A
VR8	025-038	Diode, 15V Zener	Sarkes-Tarzian VR15A
VR101	025-018	Diode, 5.6V Zener, ±5%, 1N708A	International Rectifier 1N708A
VR201	025-024	Diode, 28V Zener, ±5%	Sarkes-Tarzian VR28A
VR501	025-003	Diode, 3.4V Zener, ±5%, 1N703A	International Rectifier 1N703A
VR502	025-018	Diode, 5.6V Zener, ±5%, 1N708A	International Rectifier 1N708A
Y601	023-022	Crystal, 100 MHz	Texscan Corporation
Z601	A200-005-01	Termination	Texscan Corporation

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
Z602	A200-005-01	Termination	Texscan Corporation
Z603	A200-047	Attenuator	Texscan Corporation
Z604	A204-155	Termination, 50 ohm, ½W	Texscan Corporation

CAUTION:

Units shipped from the factory are identified for operation from the proper input power source. Note the following:

(1) 230-volt rms, 50/60 Hz, single-phase power source.

A RED label marked "230V" is wrapped around the power cord within six inches (15 cm) of the polarized power plug. A RED label marked "230V" is also attached to the rear panel of the unit above the line-cord grommet.

(2) 115 volt rms, 50/60 Hz, single-phase power source.

A YELLOW label marked "115V" is wrapped around the power cord within six inches (15 cm) of the polarized power plug. A YELLOW label marked "115V" is also attached to the rear panel of the unit above the line-cord grommet.

Damage to any unit which is connected to a 230-volt power source, but which is wired internally for 115-volt operation constitutes "misuse", and is not covered by the TEXSCAN warranty. Consult the TEXSCAN instruction manual for the proper internal power-source connection if there is any question about the intended use. NOTE: The line fuse(s) must also be checked for the correct rating and type.

CONDITIONS OF SALE

Determination of prices, terms, conditions of sale, and final acceptance of orders are made only at our plant in Indianapolis, Indiana.

All prices are F.O.B. Indianapolis, Indiana, USA.

Terms in the United States and Canada are Net 30 days if credit has been arranged.

Terms throughout the rest of the free world are arranged with Texscan's area representative.

SERVICE AND PARTS

Repair service is available at our plant in Indianapolis, Indiana. Before returning an instrument for repair, please write to us, requesting a Returned Material Authorization. On receipt of shipping authorization, forward the instrument prepaid. Care should be taken in packing the instrument to insure protection in transit. Also, state the type and serial number of the instrument, date of purchase, and details concerning the difficulty.

Repair parts may be ordered from our home plant or through our sales representatives. When ordering repair parts, please specify the part number and description of the item, and the type and serial number of the instrument in which it is used.

TEXSCAN RECOMMENDS FACTORY REPAIR OF RF CIRCUITS

If failure occurs in an RF section of any TEXSCAN test instrument, TEXSCAN recommends that the complete instrument be returned to the factory for repair and calibration. Replacement of an RF assembly or component may result in failure of the instrument to meet its published specifications and failure to perform within its design capabilities. TEXSCAN Customer Service personnel are experienced in the repair and calibration of the complete line of TEXSCAN test instruments. When practical, updated improvements can be included in the repaired instrument.

SPECIFICATION CHANGES

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold.

WARRANTY

Products manufactured by Texscan Corporation are warranted against defective materials and workmanship for one year from date of shipment. Any instrument or component which has been found to be defective during this one-year period will be repaired or replaced without charge except for vacuum tubes or batteries which have given normal service. No other warranty is expressed or implied.

ORDERING INFORMATION

In the United States and Canada, please order through your local representative or directly with the factory. Your factory trained representative can supply technical data and latest price and delivery quotations.

The factory address is:

Texscan Corporation
2446 North Shadeland Avenue
Indianapolis, Indiana 46219
Phone: 317-357-8781
TWX: 810-341-3184
Cable Address: TEXSCAN

In Western Europe, please order through your local representative, who can supply technical assistance and up-to-date price and delivery information.

Complete addresses and telephone numbers of Texscan's sales representatives are listed on the outside back cover of the catalogue.

SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order, we shall use our own judgment as to the best method of shipment. Unless otherwise specified, normal shipments will be by air freight or air express. Small items are sent via parcel post. The listed price for our products include the packing, but does not include the cost of shipping.

IMPORTANT!

WARRANTY AND SERVICE INFORMATION

Products manufactured by TEXSCAN CORPORATION are warranted, to the original purchaser, against defective material and workmanship for a period of one year from the original date of shipment from our plant. This warranty is limited to the replacement or repair of components or parts found defective within this one-year period, including the labor involved in their replacement, when the product is returned, shipping charges prepaid, to our factory in Indianapolis, Indiana. It does not apply to normal service items, such as batteries, tubes or appearance items which have given normal service; nor does it apply to damage caused by abuse, misuse, mishandling, or damage caused by shipment, unauthorized modification, repair, or attempted repair. In fulfilling this warranty, TEXSCAN'S liability is limited to the repair of this product. The company assumes no liability for any consequential damage.

In the event that you experience difficulty with this unit, please write Customer Service Dept., TEXSCAN CORP. 2446 N. Shadeland Ave., Indianapolis, Indiana 46219, or call (317) 357-8781. If return of this unit to TEXSCAN is authorized, you will be given a Repair Authorization number, which must be marked on the outside of the shipping container. Enclose the additional information requested below and forward the unit, shipping charges prepaid to TEXSCAN. All service work is FOB our plant in Indianapolis, Indiana.

Overseas customers should contact our local sales representatives.

Service is also available, at nominal cost, for older TEXSCAN products. Please follow the same procedure described in the preceding paragraph, even though you are requesting non-warranty repairs. Not only will you help expedite the unit to Customer Service, but you will also have established your priority.

All units handled by our Customer Service Dept. are carefully re-inspected by our Quality Assurance Dept. to ensure that they function in accordance with the specifications which were applicable at the time of their manufacture. We reserve the right to make product improvements and changes, without incurring any liability to modify equipment previously sold. However, we do occasionally find it more expedient to update portions of older models rather than attempt repairs.

Should you desire to perform repairs in your own facility, approved replacement parts may be purchased through our Customer Service Dept. Please order by TEXSCAN part number and specify the model and serial number of the instrument in which it is to be used.

REPAIR AUTHORIZATION NO. _____ DATE _____ YOUR P.O. NO. _____

TYPE OF EQUIPMENT _____ MODEL _____

SERIAL NUMBER _____ DATE OF PURCHASE _____

OWNER'S NAME & ADDRESS _____

FOR FURTHER INFO, CONTACT _____

DESCRIPTION OF PROBLEM _____

_____